be done by almost anybody with good will and a little perseverance. Now, the way to master a subject is to begin at the beginning. Suppose you want to know about Greek literature. You have noted one of Macaulay's or Matthew Arnold's glowing tributes to the noble simplicity of Grecian writing, and you want to read about it. Get Jebb's "Primer of Greek Literature," which is almost as good as Stopford Brooke's "Primer of English Literature"—as high praise as one can give any book of the kind. This will tell you the conditions under which the Greeks worked. Then if you are attracted toward any other writer, and want to know more about him, get the volume in which he and his works are discussed at length in the series of "Ancient Classics for English Readers." By the time you have read that, you will know whether you really want to study this Greek author or not, whether you are capable of appreciating him, and, therefore, whether your time and attention can be given to him with advantage.

As soon as the taste for reading is formed, that taste begins to improve, and its improvement should be sedulously cultivated. Every man who has read a great deal will tell you that he has left far behind him the books he admired when he began. What he admired at twenty is far inferior to what he admires at thirty or forty. He is constantly going up a literary ladder. Now, it makes little matter on what round of the ladder the reader begins, so long as he climbs. It is the act of climbing which is beneficial, not the elevation attained. If you are a boy, and you read for excitement, for adventure, and for this reason take a story-paper, give it up, and try one of Mr. Towle's series of books about the "Heroes of History," or one of Dr. Eggleston's "Lives of Famous Indians." If Mr. Towle's "Pizarro" attracts you, go from that to Prescott's narrative of the conquest of Peru; and from that you may be led to his other histories of the Spanish dominion in America, and Prescott may thus introduce you to Irving and to Motley. And when you have got so far, the whole field of European history is open before you. Get the best —the best, that is, that you can read with satisfaction, and then go onward and upward. One caution may be thrown out here. When you want to know about any man or period and seek a history to tell you, do not take a school-book; they are only too often dry and colorless.

And this brings us to those who know what to read, but desire advice as to how to get the best results from their reading. Having formed the habit of reading, and having thus got your foot on the ladder of literary culture, how are you to get the best result from these? First of all, always think over a book when you have finished it. Criticise it. Form your own opinion of it. If you liked it, ask yourself why you liked it. If you disliked it, ask yourself why you did not like it. See if the fault was in the book or in you. If you were greatly interested, try to find out whether this was due to the author or to the subject. Then if you can find somebody else who has read the book, talk it over; exchange your impression for his impression; and see whether, on sober second thought, he is more nearly right than you. If you have been reading a great author, see what the great critics have been saying of him. If you have been reading an essay on a great author or a biography of him, take up his own works next, that you may gain the benefit of the interest around about him. If you have been reading any special history, try to see how it fits into the general history of the world: and for this purpose, I know no books to be compared with Mr. Freeman's "Primer of European History," and his "First Sketch of History." These begin at the beginning and tell the march of events to our generation.

Then, as you are reading a book, it is well to mark important passages. If the book is your own, make a light mark with a hard pencil in the margin of the passage. If the book is not yours, put in a slip of paper. When you have ended the book, read over the marked passages, and index those which on this second reading seem worthy of it, or likely in any way to be of use to you. If the book is yours, turn to the blank page at the end and give a hint of the passage and the page it is on; thus:

John Brown, p. 21,
Shaksperean quotation, p. 47,
Anecdote of a wise dog, p. 93,

and so on. If the book is not yours, take a page in a note-book, or a sheet of note-paper, and make your index on that, heading it with the title of the book.

The Rev. Joseph Cook tells us that he marks important passages with a line in the outer margin of the book he is reading, more important with two lines, and most important with three; while passages that he disagrees with or disapproves of, are marked in like manner with one, two, or three lines on the inner margin. He advises the committing to memory of the passages marked with three lines on the outside margin. The reader should also strenuously cultivate the habit of searching diligently in dictionaries and encyclopedias and gazetteers, and in whatever books of reference he can get access to. He should let no allusion pass without an effort to find out what it means. Macaulay bristles with allusions, but there are scarcely any that a quick reader cannot dig out of an encyclopedia in a few minutes. And "when found make a note on,"—as Cap'n Cuttle tells us.

Arthur Penn.

THE WORLD'S WORK.

Progress in Smoke Abatement.

The necessity of getting rid of the clouds of black smoke that overhang all towns where bituminous coal is used in domestic fires, has led to the invention of a large number of new stoves and fire-places. In all these inventions the aim is to prevent the formation of smoke by a more complete combustion of the fuel. Smoke is simply a fine dust composed of carbon. This carbon dust will burn, and the whole art of preventing the formation of the dust is to insure the complete combustion of the fuel. To accomplish this, inventors have tried two apparently different methods. One way is to make a fire-place in which fresh coal may be added in such a way that it may be "cooked" or prepared for burning before it is wholly consumed. As such fire-places are made on the principle of the gas retort, they may be called coking stoves. The other method is called the regenerative system. The idea here is to heat the air needed to maintain the fire, and thus to secure a better combustion of the fuel. A number of these smoke-preventing stoves and furnaces have already been described in this department. One of these inventions on the regenerative plan has proved to be a commercial success, and it has been introduced into a great number of places. At the Smoke Abatement Exhibition, recently held in England, a number of new smoke-preventing appliances were shown. In one stove and open grate there is a small trough at the front of the grate, into which the fresh coal is put, and from this place, when it has been partly coked, it may be passed by means of a small scraper into the fire, and under the coals already burning. In another grate, two Archimedean screws are used to raise the fresh coal into the fire from a holder, or coal-box, under the grate. In another grate, a gridiron, or rake, under the grate-bars rises, and lifts the whole bed of live coals. This makes a small space or cave under the fire, into which fresh coal may be placed. The iron rake is then withdrawn, letting the live coals down on the raw fuel under it. Another invention puts fresh coal under the fire by means of a pivoted box under the grate-bars. This box may be turned on its pivoted support so as to bring it out in front of the fire. In this position a slide covers an opening in the center of the grate. The box is filled with coal, and is returned to its position under the fire. The slide is withdrawn by the same movement, and by means of a false bottom in the box, the coal is lifted through the opening in the grate, into the fire. Another grate is made in the form of a cylinder (already described here), supported on its axis. It is filled with fuel, and when this is partly lighted the grate is turned over, bringing the fire on top. The fire then burns downward till a part of the fuel is consumed, when it is refilled and turned over again. Besides these grates, there is a new shovel in the form of a wedge-shaped box. When filled with coal, the shovel is pushed into the fire, sliding on the grate-bars, and lifting the live coals. When it is fairly under the hot fuel, a lever is moved, the box is opened and the fresh coal pushed out, when the shovel may be withdrawn, leaving the coal under the fire. In other new fire-places, the fresh coal is pushed into the fire from the back or sides by various appliances, so that the fresh coal is exposed to the heat, and is thus coked before it takes fire.

In the other class of smoke-preventing appliances, the unburned carbon that escapes from the fire is met just beyond the grate by streams of highly heated air, and in this hot air it will take fire and burn. Smoke is formed because there is not sufficient air to enable it to burn, and if the smoke, immediately after it has left the fire, meets a fresh supply of air, some of it will burn. If this fresh air is highly heated it will burn all the more readily, and if the apparatus is properly designed and constructed, all the smoke will be consumed. Among the new appliances shown at the Exhibition, was a grate having hollow grate-bars open at the front end to the air, and communicating with pipes that open into the flue just behind the fire-place. Fresh air is drawn through these hollow grate-bars and is highly heated. It meets the products of combustion, and the unburned gas and smoke take fire and burn with great heat at the ends of the pipes. Various inventions were also shown, wherein the same thing is accomplished by drawing fresh air through sinuous passages at the sides of the fire-place. All these inventions are more or less close imitations of a well-known regenerative furnace for steam-boilers, invented in the United States several years ago, and now in successful operation in many parts of the country.

In the first class of grates and stoves, where the fresh fuel is coked or placed under the live coals, the smoke is burned by passing through or over the hot fuel already burning. There is in all these stoves more or less waste of heat from the escape of the unburned and invisible products of combustion, and for this reason the regenerative plan must be regarded as decidedly the best.

Another apparatus on the regenerative system consists of a steam injector. This is simply two pipes, one within the other, and placed directly over the fire in a steam boiler. The smaller pipe, placed within the larger pipe, is for steam, and the larger pipe is for air. The blast from the steam causes a suction through the larger pipe, and throws a stream of mingled air and steam into the furnace just beyond the fire. The air is heated by the fire and the steam, and assists combustion precisely as in the case of those furnaces where hot air is mingled with the products of combustion, in the regenerative furnaces already described. The use of the steam is, of course, a loss, but in the case of this apparatus it is said to be a loss of only one per cent., whereas the gain of heat from the more complete combustion of the gas and smoke is said to be as high as twenty-five per cent. It must be said, however, that the use of steam in this way appears to be generally regarded as a doubtful economy.

Improved Printing-Plates.

EXPERIMENTS have been made, both here and in Europe, with celluloid as a material for types, and the material has been found to have some advantages over type-metal and wood. It takes clear and sharp impressions under the influence of heat and pressure, and will keep its shape under the hardest usage. The celluloid is used in the form of thin sheets or plates, and is intended to be backed by wood. In nature-printing, as in copying leaves, mosses, laces, and all kinds of raised fabrics, the leaf or fabric is laid on the sheet of celluloid and submitted to heat under considerable pressure. The material will be pressed into the celluloid, and when finished the plate will exhibit the minutest veining or threads of the fabric or leaf. By cutting away the edges of the plate, the leaf may be brought into relief and used as a stereotype plate. These celluloid plates have so far been applied to the manufacture of large types only, such as are now made of wood, and to the making of small plates containing short notices or advertisements for newspapers. The advantages of the celluloid types and plates consist in their lightness, which saves storage and postage, and in their durability and cheapness. The types resist the action of acids and do not affect the colors of the inks used on them. This makes it possible to use the same type for many colors, which is a great advantage in printing-offices where wood type is used.

The Radiometer in Measuring Light.

THE radiometer bulb, with its white and blackened vanes, is a familiar object in the windows of opticians, but, while it has been the means of making important experiments in physics, it does not appear to have proved of much value in the arts. It has been suggested recently that it can be used as a photometer in testing the power of different lights. The radiometer bulb is placed in a square metallic box having openings opposite the bulb on opposite sides, and closed with glass. The box is filled with water that is raised, by means of a lamp, or other appliance, to a temperature about one hundred degrees higher than the heat that may be given by the two lights to be examined. The beam of light from the candle, or other standard, is then allowed to fall on the vanes of the radiometer through one of the openings in the box. The light to be tested is allowed to fall on the vanes, through the opening on the opposite side. If the two lights are of equal power, the action of the lights on the vanes will balance, and the vanes will stand with one face toward one light and the other toward the other. If the power of the lights is unequal, the stronger light will displace the vanes or cause them to revolve. To measure the photometric power of the light to be tested, it must be moved farther away or nearer to the bulb till the balance is set up. The distance of the lights from the bulb will then give the value of the light, as in any of the photometers now in use. The observation of the action of the vanes is studied through the openings on the opposite sides of the case in which the radiometer is placed.

Hydraulic Dispatch.

A NOVEL form of dispatch-tube for transmitting letters and packages under rivers or harbors has been made the subject of experiment. The plan is the same as in the dispatch-tubes already in use in cities, where light carriers containing letters are blown or drawn through metal pipes by a powerful current of air, except that water is used instead of air. The tube is of thin lead, bound with wire on the outside to give it strength, and covered with tarred hemp to resist the action of the water. The pipe is simply laid on the bottom of the river, the shore ends being placed in a trench for safety. To obtain power, a reservoir is placed at each end of the pipe at a sufficient height to insure a good head of water. The reservoir is connected, by a pipe of equal diameter with the tube, with the top of a box at the shore end. The tube enters the lower side of this box, and there are valves at the end of each pipe, and a water-tight door at the side of the box. The carrier consists of a wire cylinder covered with rubber and closed by a water-tight cap. The messages are placed in the carrier and it is put in the box with others, and the door is closed. The valves are opened and the water, under the pressure from the reservoir, sweeps or floats the train of carriers through the tube at a speed corresponding with the pressure. At the receiving end the water is discharged through a branch pipe into an open box or sieve, through which the water escapes, while the carriers are caught. The transmitting and receiving apparatus are the same at each end of the tube, and by reversing the current, messages may be sent either way. The chief advantage of such a hydraulic system of transmission will probably be found in the greater distance to which the carriers can be sent. As they float in this tube, there will be less friction than in pneumatic tubes, while leakage in the tube will be of less consequence. The commercial value of the system will depend on the relative cost of pumping air or pumping water through such a dispatch-tube.

Recent Progress in the Application of Electricity to Railroads.

THE experiments that were begun some time ago in this country, in the use of electricity on railroads, have been renewed recently upon a greatly enlarged scale. A new narrow-gauge railroad has been laid down on precisely the same conditions in regard to grade and curvature as would be found on ordinary railroads in the United States. A new locomotor with one car, of the ordinary single-horse pattern used on street railways, has been provided, and it is proposed to run the motor and the car continuously under all weathers for a year, in order thoroughly to test the system under every condition of the weather and the seasons.

The direct motive power is a stationary steam-engine located at the top of a hill, about a thousand meters from the nearest point of the railroad. Three dynamo machines are driven by belting from the engine, and these give the current for operating the road. These machines may be used in one of two ways. They may be joined to the wire to give a current that will cause the locomotor to move at a high rate of speed, or with power at a slower rate. If the current from one dynamo is sent into the next, and so on, in series, the current made available for work gives speed. If the current from each machine is sent direct to the wire, the combined currents give intensity or power. At the time the road was examined they were arranged in this way, as the track was new and a trifle rough. From the central station where the dynamo machines are placed, the wires are laid under-ground to the road. The insulation is secured by inclosing the wires in a wooden box filled with an insulating compound, poured in the box and over the wires while liquid. The track consists of square wooden ties and a light rail, laid in the usual manner. To secure insulation, the ends of each tie are painted with an insulating liquid that, when dry and hard, makes a good non-conductor. In placing the ties on the road-bed, care is taken to leave the ends of the ties exposed, so that the rail will not touch the ground between them. The rails are also painted with or dipped in the insulating compound up to the lower side of the tread. This gives the rails the appearance of being painted black at the sides and bottom. The sides of each rail at the ends are also filed or brightened so as to leave a clean surface, and when they are in place on the track, short bars of copper are laid from rail to rail across the joint. Each bar bears against this bright or bare spot on the rail, and is securely held in this position by the fish-plates. A little solder is also applied, to insure good electrical connection from rail to rail through these copper bars. To assist the insulation, there is also a small piece of insulating material placed on the tie under the rail. On this is also laid another insulator wherever the heads of the spikes rest on the rail. With such a track the loss of electricity by escape into the ground, per mile of track, is found to be very small. The cables from the central station are connected directly with the track, one to each rail, and at a point near one end of the road. This is, however, not a matter of much consequence, as the central station may be at the middle of the road or at either end, while the cable may be carried under a river or across a hill or valley.

The motor consists essentially of a single dynamo machine, of precisely the same pattern as those used to furnish the current. It is laid down horizontally with the armature at the forward end over the driving-wheel. The motor is supported on four wheels, one pair forward being the drivers, while a trailing pair is placed behind under the cab. There are no trucks, as the motor is supported on a rigid frame-work. As the whole machine is small, the wheel-base is about the same as in the horse-car, and it will pass ordinary curves with ease. Motors of a larger size, and carrying two or more dynamo machines, would be arranged differently, perhaps, with two driving-wheels and one trailing truck. The armature of the magnet is secured to a horizontal shaft at the front of the motor, and from this shaft is a belt to a counter-shaft at the rear under the cab. The counter-shaft carries a friction clutch, controlled by a hand-lever in the cab. From the counter-shaft is taken another belt to the axle of the driving-wheel, and over this belt is a belt-tightener, controlled by a hand-screw in the cab. The four wheels are made of iron, in two parts, with a backing of wood, somewhat after the manner of paper car-wheels. The wood serves as an insulator, and prevents the current that flows from the track into the wheels from taking a short circuit through the axles from rail to rail. On each wheel are fastened brass arms, arranged to support a round brass disk opposite the center of the wheel, but not touching it. On this disk rest copper brushes, supported by a brass rod, that communicates with an insulated wire that connects with the magnet. The current from one rail passes through the tread of the wheels on that side, then through the brass arms to the copper brush, and thence by the wire to the magnet. In like manner the current returns to the rail on the other side. In this way, the motor becomes a bridge or short circuit on the rail that is continually changing its position while in motion. This is precisely the same as in those electric block signals (already described in this department) where the current is made to pass from rail to rail through the first or last axle of a train moving in the block. In such signal systems, the moving train is merely an electric shunt or switch, and it receives no direct benefit from the current. In this motor the current passing through the apparatus does useful work in moving the train. All the switches for sending the current through the magnet in either direction, or for stopping, starting, and reversing the machine, are placed in the cab, and the whole work of control consists in moving these simple hand-levers, in moving the friction-clutch lever and the belt-tightener. There is also a hand brake.

At the time the road was inspected, the motor pushed the car containing several people, and dragged behind a small flat-car loaded with gravel and carrying two men. The motor was controlled by one engineer and one assistant. In starting, the switch was turned to admit the current to the magnet. The armature, turning idly before, began to revolve swiftly, and in a few seconds was moving at a high speed with a slight whirring sound. On applying the friction clutch, the motor started ahead easily, and in silence. On applying the belt-tightener a good speed was at once attained, and the train ran swiftly over the road for more than a mile without stopping. On taking off the flat-car load, the return trip was made at good speed, and apparently without effort. No attempt was made to display the highest speed possible, but enough was done to show that the motor could be handled with the greatest ease, and with entire precision. When used alone, the motor ran backward and forward, stopped, and started as readily as any locomotive, and without noise, dust, or smoke. While this road has been built for experimental purposes, enough has already been done to prove that it is a practical success. Such a road and motor will, no doubt, prove of great value wherever ordinary locomotives are objectionable, as in mines, tunnels, and city elevated roads. Short spurs or feeders to regular railroads, particularly where water-power is available, could be built on this system to advantage, and there seems no reason why it may not prove of great value. In point of simplicity and directness of means to ends, the motor and its road appear to be superior to the electrical railways already in use.

Improved Chain-Pump.

THE chain-pumps, so extensively used in some parts of the country, always had the defect of great wastefulness, both in time and power. The metal buttons used for buckets in the chain tube were too small, and allowed the water to run back too freely. An improved rubber bucket, in the form of an inverted cup, has been introduced, that appears to remedy the defects of this otherwise useful form of pump. The buckets fit the tube closely, and prevent the water from falling back.

sediment, or fail to act from some other cause, and then the water-seal of the trap on the safe-waste dries up, and there is nothing to prevent sewer-gas passing through it. This little trap may also be siphoned by the discharge of the closet or other fixture, when the same ill results will follow. In good plumbing work, therefore, it is the rule to carry the safe-wastes down to the cellar, or to empty them over a sink where they can do no harm.

Care should be taken to prevent rats nesting about plumbing fixtures, as they will gnaw the pipes if impelled by thirst, and sometimes they will eat into vent-pipes and thus leave openings for sewer-gas, which will not show themselves, as in ordinary cases, by leaks. It is also important to see that the openings in the floor below a water-closet to admit the plumber's pipes are closed at the top, as they may admit cellar air, and also increase the risk of freezing the supply-pipes.

Servants' water-closets are difficult to keep in order, both from their poor quality and the want of care in looking after them. Being out of sight, they are easily out of the mistress's mind. It is rare to find them cleanly or in good repair, but it seems to be thought that anything is good enough for servants. They should never be placed in a cellar unless the latter is well lighted and warmed. Any appliance that is to receive hard usage should be of the best construction and material; hence the servants' water-closets should be of the best make instead of the reverse, and located where the comfort of the domestics will be considered as far as possible. Much might be said regarding the sanitary provisions for domestics. Householders should reflect that their own and their children's welfare is involved in the health of their servants. More than one serious outbreak of sickness in families has been traced to the failure to care for the health of servants.

Charles F. Wingate.

THE WORLD'S WORK.

Protection for Workmen.

We have already referred to mica masks for the protection of workmen exposed to great heat.* Among the new devices for economizing the cost of labor by making the laborer more comfortable, or in guarding him from injury, is a water shield for furnaces. It consists of an apron of sheet-iron, suspended before the furnace, over which a film of cold water is allowed to flow continuously. The apron may be of any size or shape desired, and may be hinged at one side, or suspended on rollers, so that it can be pushed out of the way when it is necessary to open the furnace doors. The upper edge of the apron is bent slightly back, and just above the receding portion is placed a pipe pierced with holes along the lower side. This pipe is joined by means of a piece of hose to the water supply of the place. The lower edge of the apron is bent upward so as to form a trough, and this is connected at one end with a hose for carrying off the waste water. When the shield is in place before the furnace, water is let on through the hose, and escaping from the pipe it flows in a film down the outside of the shield, absorbing the heat of the furnace, cooling the air in front of the furnace, and catching much of the dust that may be in the air. The waste water from the trough may be used for cooling tools used in the furnace, or for any other purpose, or it may be run into a reservoir, and after cooling may be used again. The cost of the shield is very slight. Among appliances for protecting workmen while placing belts over driving pulleys while in motion, is a piece of sheet-iron formed in the shape of a spiral flange, fastened to the edge of the pulley for half its circumference. At one end it is as wide as the face of the pulley and at the other end it narrows to a point. It thus makes a supplemental face for half the circumference of the pulley, and having a spiral edge. On directing the belt, by means of a rod carrying an arm at the top, over the pulley, it meets this attachment, and is, as it were, screwed into place. If it fails to catch the first time it may be taken at the next revolution, and is then easily pressed over upon the face of the pulley. The device has been examined by experts, and is highly recommended as a cheap and ready means of preventing the accidents that so often arise in placing large belts in position. It does not appear to be patented. In lubricating appliances for engines or reciprocating machinery in motion, an automatic oiler, sometimes used in marine engines, deserves notice. It consists of an oil-cup of any convenient shape, having a hollow tube or pipe extending through the bottom, and reaching nearly to the top or cover. A wick, regulated by a screw, is passed through this pipe, and, dipping in the oil by being bent over the top of the pipe, hangs down below the cup. By capillary action the oil gathers at the lower end of the wick, the flow being regulated by the screw. The cup is intended to be suspended over a crank for lubricating the pin, or over any moving machinery, where the occasional delivery of a drop of oil is required. The flexible wick touches the crank-pin, cross-head, or other part of the machinery as it passes it, and thus all the dangers that attend oiling by hand are avoided. The wick in some forms of cups is replaced by a flexible metal strip, or spring, down which the oil flows. The end of the spring just touches the moving machinery, as it passes under it, and the oil is dashed or knocked off upon the place where it is needed. The wick would seem to be the safer and more economical plan, as it will yield most readily to any irregularity in the motion of the machinery. No patent appears to have been

* See "The World's Work" for February, 1882.

taken out on this form of oil-cup. A safety shield for circular saws has also been invented, that deserves commendation. It consists of a hood or shield, designed to fit over the upper part of the saw that projects above the table. The hood is pivoted upon an arm over the saw, and is kept in place by a weight when the saw is not in use. The end of the hood in front of the saw has a lip or projection, designed to slip over the log or other piece of wood that is to be cut by the saw. The log, as it advances toward the saw, thus lifts the shield, and passes under it, supporting it till the cut has been made, when the shield falls back over the saw. The shield is so arranged that it will fit over any size of saw, and can be adjusted to fit the saw as it is worn away.

Novel Application of Photography.

LANTERN slides are now made directly from photographic negatives by the use of a special kind of dry plate (quarter size), which is laid upon the negative in a printing frame and exposed for a few seconds to the light of an oil lamp. The plate may then be developed with ferros-oxalate in the usual manner. By a new application of this process, lantern slides of many natural objects may be made directly from nature, without the use of a camera. Anything that is more or less transparent or translucent, and that may be pressed quite thin, such as the leaves of plants, sections of wood or other organic formations, sections of minerals, metals, fossils, or the thin parts of insects, wings, etc., may be copied directly. In the experiments made, young leaves from a rose bush were laid upon a sheet of clear glass in a printing frame. The dry plate was laid face down over the leaves and the printing frame was closed. On exposure for three seconds to the light of an oil lamp, the dry plate was developed strongly to get great intensity in the film. The result was a lantern slide having the rose leaves as a positive image sharply defined. The light also passed through the leaves, and every rib and vein in the tissue of the leaves was accurately copied in the minutest detail. In a lantern the slide gave a greatly magnified picture of the leaf, showing the minute views that were not visible to the eye in the leaves. This offers a cheap and ready means of copying natural objects for study or for illustration of lectures, and by projecting the picture upon a screen a large number of people may examine enlarged copies of small natural objects. Negative prints can also be taken on ferro-prussiate paper or on silver paper, as in printing ordinary photographs. In this case, the leaves would appear black on a white ground, while in a lantern they would be white on a black ground. Further experiments are being made in this direction.

Improved Elevators.

A NUMBER of patents have been taken out in this country on appliances for closing elevator shafts above and below the elevator, as it moves up and down. The most recent of these inventions employs a series of movable floors or covers in the shaft that are controlled by the movement of the elevator car. Half of these, corresponding to the number of floors in the building, are above the car and half below. If the car is at the bottom of the shaft, all the covers above are in place, each one resting securely on ledges or projections at the corners or sides of the shaft. The other set of covers are at the same time laid in a heap on the floor of the shaft, under the car. At the four corners of the shaft, both at the top and bottom, are pulleys, or grooved wheels, and over each pair, above and below, is carried a small wire rope. One end is fastened to the top of the car and the other end is fastened to the bottom of the car. By this arrangement, each rope becomes an endless band, moving easily up and down with the car. These ropes pass through holes in the corners of the platforms or covers, and do not affect them in any way till required. Just above the top of the car is a knot in each rope, and when the car rises from the bottom of the shaft the ropes pass through the holes in all the covers above till the knots meet the covers on the second floor. As the knot cannot pass, the cover is raised and is supported by the ropes. At each floor, in turn, this cover takes up each of the covers till all are raised, and the car is at the top floor. All the covers above now rest above the car, and in descending each in turn is left behind in its proper place, resting on the supports fitted for it, these supports being arranged to support only the cover intended for that place. The covers below are also provided with holes at the corners, through which the ropes pass. On the ropes are fixed balls or knots of different sizes, and as the car rises, dragging the ropes after it, all the floors are raised, and each is supported by its proper set of knots on a level with the floors of the building.

New Exploder for Firing Blasts.

A SIMPLE mechanical device for firing explosives of all kinds has been introduced, that is designed to prevent all danger that might arise from firing blasts by means of a fuse or fire in any form. It consists of a small metal cylinder containing a piston or hammer, designed to strike an anvil or nipple at the end of the cylinder. This hammer is moved by a spring, and, to prevent the hammer from striking on the anvil, it is securely soldered to the other end of the cylinder. When ready for use, a fulminating cap is placed on the anvil, and the other end of the cylinder is closed by a cap containing a small quantity of quicksilver. The solder used to fasten the hammer is composed of materials that are readily decomposed by quicksilver. When the exploder is to be fired, the quicksilver is brought in contact with the solder, either by turning the cylinder upside down, or by any other simple arrangement of the parts; the solder is softened and the spring released. The spring then drives the hammer upon the anvil, striking the cap and firing the explosive. The apparatus has the merit of getting rid of fire in such exploders and making it possible to regulate the time of firing.

Novel Application of the Expansion of Metals.

THE fact that different metals expand differently under the influence of heat has recently and, it is believed for the first time, been made of use in the arts.

For instance, gun metal exposed to a certain temperature will expand a certain amount. Steel exposed to the same temperature will expand less. This difference of expansion between two materials has been made of use in a new oil-cup for lubricating machinery. The oil-cup is of gun metal, and has double walls and double cover, etc., as in other forms of cups. The novel feature of the apparatus is a hole in the bottom of the cup, through which the oil is to pass when required. This opening is closed by a steel plug, that fits tightly into the hole so long as the cup is cold and not in use. On admitting hot steam to the under side of the cup the two metals are heated and expand, but as the ratio of expansion of the gun metal is the greater, the hole becomes larger than the steel plug. The plug has expanded, but in a lesser degree, and this difference of expansion leaves an annular opening between the plug and the hole or its seat. Through this opening the oil escapes. When the engine stops and the oil is no longer needed, the steam is withdrawn. The oil-cup then contracts, and the plug again fits tightly upon its seat and cuts off the flow of oil. The apparatus gets rid of all wicks or other movable parts liable to wear out, and has the merit of being self-acting. It would seem that this application of the unequal expansion of different metals might prove of use in many other ways. Hot liquids could in the same manner be used to open escape or relief valves for their own passage, by arranging the valves in such a way that the heat of the liquids would operate on metals of different degrees of expansion.

Controlling the Waves at Dock Gates.

Oil spread upon the surface of the water tends to prevent the cresting or breaking of the waves in storms, and thus, in a measure, renders the waves less dangerous to vessels. Oil-springs under the sea have in the same way caused "slicks," or spots of comparatively still water, to appear on the sea over the springs. This familiar fact has never been made of any use, except in isolated cases of shipwreck, until recently. Many artificial ports or small harbors of refuge have very narrow entrances, and these are often exposed to heavy seas, which make the passage of vessels trying to enter the port very dangerous. For the experiment we are about to describe, the narrow entrance of such a port was selected and pipes were laid into the water from the beach, the pipes resting on the bottom and being left open at a point under the entrance where the waves were generally most dangerous. A small hand-pump was connected with the land end of the pipes, and a supply of cheap oil provided. On the appearance of a storm the apparatus was got ready, and when the waves were breaking badly at the entrance of the port, oil was pumped into the sea through the pipes. In a short time, the oil began to rise and spread in a film over the water, preventing the wind from breaking or feathering the waves. The billows were made sufficiently smooth to render the water perfectly safe for the smallest boats. The experiment was regarded as entirely satisfactory, and it is suggested that oil-pipes be laid under water at all dock and port entrances where the waves are a source of danger. One hundred gallons of oil were used in the experiment, but this would be a very small expense in case of an emergency when the fate of a ship and crew might depend on the character of the seas to be met in seeking the port in a storm.

New Milling Appliances.

The most radical changes that have been made within the last few years in the art of grinding or milling appear to be toward some substitute for mill-stones. Disintegrating machines, attrition and atomizing apparatus have been introduced, with the view of performing the work of grinding without the aid of burr-stones. Among the more recent of these attrition mills is an invention in which the material to be ground is broken against itself instead of being broken against stones, as in the old methods, or against revolving paddles or arms, as in some forms of disintegrators. The new apparatus consists essentially of a revolving chamber, some simple form of air-exhaust for removing the fine dust or flour as fast as it is ground, and a settling chamber where the flour may be separated from the finer dust. The mill consists of a cylinder of metal, supported at one side by a horizontal shaft which causes it to revolve. There is an opening at the opposite side, through which the material to be ground is put in the mill or drawn out when floured. Through this opening may also be inserted a curved arm, or plow, which reaches nearly to the sides of the cylinder. When the apparatus is started, the material to be ground is allowed to run into the cylinder while it is revolving rapidly. By centrifugal action, the material is quickly gathered in a ring clinging to the outer sides of the cylinder. In position, no action of any kind takes place. The curved arm is then moved into the cylinder, where it nearly touches the sides, the ring of material moving round with the cylinder passing under it untouched. More material is then added, and, as it increases the thickness of the ring, a part is caught in front of the arm. The arm now acts as a plow, stirring up the material moving in the cylinder. The heap that gathers in front of it is brought into violent attrition with the material that passes under the plow, and in this way it is ground against itself. Neither the sides of the cylinder nor the plow are much worn, for the grinding action appears to be between the belt of material clinging to the sides of the cylinder and the mass in front of the plow. As fast as the material is reduced enough to cause it to float in the air, it is drawn out by the exhaust and is conveyed through pipes to the settling-chamber. Any excess of flour or finer dust is carried on to a still larger settling-room, where it may be collected. The details of the invention, as applied to the work of grinding phosphates, etc., appear to be well worked out.

Recording Music.

A great deal of time and money have been spent by different inventors in the effort to make some kind of a machine that would record the action of keyed musical instruments. None of these experiments has hitherto proved of any practical value to the musician.

The action of the keys has been mechanically recorded upon a strip of paper, but the marks do not appear to represent the music produced by the movements of the keys in anything like an intelligible manner. The most recent experiments in this direction have combined the use of electricity and a novel application of the automatic musical instruments invented in this country a few years since. These musical instruments (already described in this department) depend on the use of a perforated band of paper and a set of reeds or pipes. The paper band is drawn over openings that admit air to the reeds, each of the perforations admitting air and causing the reed to sound. In the new apparatus, the movement of an organ key makes or breaks an electric circuit. On depressing the key, the circuit is closed in a wire leading to the recording machine. This consists essentially of a series of knives and a band of paper that is arranged to pass by means of rollers over the knives. The closing of the electrical circuit brings one knife into action, and a perforation is cut in the paper corresponding to the length of the note in the music. As each key has its own electric circuit and knife, a number of perforations may be made at the same time, and thus several notes may be recorded at once. The perforated band may then be placed in an automatic instrument and used to reproduce the music played on the organ. The perforations may also be translated into ordinary musical characters. It may be suggested that, while this apparatus is reported to be a practical success, it is much too complicated. If the keys of a piano or organ can be used to close an electrical circuit, it would appear a much better plan to cause the electricity to record a mark by staining a band of chemically prepared paper, as in the familiar chemical systems of telegraphy. By previously making the band of prepared paper in parallel lines corresponding to the musical staff, the reading of the stains on the paper would be comparatively simple. To secure the marking of the time a separate circuit might be closed by a pedal, a touch of the pedal by the foot marking the accent or beginning of each measure by a distinct and separate stain on the paper. This suggestion is made in the hope that the idea will be made the subject of experiment. A cheap and trustworthy recorder of music, that will give a report that can be played at sight, as from ordinary music, would, no doubt, prove of great scientific interest, and perhaps of some commercial value.

BRIC-À-BRAC.

Longfellow's Inscription on the Shanklin Fountain.

THE following quotation from a private letter, dated Shanklin, Isle of Wight, Oct. 1st, 1879, will explain an allusion in the editorial on Henry Wadsworth Longfellow, in "Topics of the Time":

"Just look at this group of thatched cottages! The one on the right is a library where we go for books. In the middle is the Crab Inn. Do you see what looks like a pile of stones to the right of it? That is a fountain for the use of the public. I read some verses painted there on a piece of tin, and said to myself: 'That must be from Longfellow.' I found afterward that they were written by him, by request, when he was here, some years ago:

'O traveller, stay thy weary feet;
Drink of this fountain, pure and sweet;
  It flows for rich and poor the same.
Then go thy way, remembering still
The wayside well beneath the hill,
  The cup of water in His name.'"

Parson Murray, of James City, in Virginia.

HEAD peruked and shaven face,
Stately step, and air of grace,
  Suit severe of somber black,—
Smiles across his lips go fleeting
While he gives My Lady greeting,
  With a swift bend of his back.

"Dine on Thursday. What could be
More delightful? Then, D. V.,
  I shall be here on that day;"
And a lowlier bow then made he,
Kissed his gloved hand to My Lady,
  Mounted steed and rode away.

Parson Murray. Past the road
Where the fallow fields lie broad,
  In the grove of trees up there
Parson's house-lights faintly glimmer,
As the evening light grows dimmer,
  And more cool the evening air.

Never voice of scolding wife
Maketh sad the parson's life,
  Never voice of crying child.
And the winter evenings closing
Find him dreaming, reading, dozing-
  Drinking knowledge undefiled.

Slippers for the parson's feet
(Which, in sooth, are slim and neat)
  Soft white hands have made a score;
And the bright eyes on him glancing
Sometimes set his heart a-dancing;
  This they do—but nothing more.

All the men the country 'round
Fear his small-sword's lightest wound;
  In a fox-hunt no one's horn
Is so lusty in its warning,
On the fine November morning,
  Just before the sun is born.

At the ball where all the girls—
White arms bare and shining curls,
  Sparkling teeth, and heavenly eyes—
Set the young bucks' hearts a-tremble,
Where the county's best assemble,
  Parson carries off the prize.

To the gay young gallants there,
Buckled pumps and powdered hair,
  Parson Murray yields no whit
In the stately dance, whose measure
Is the cadenced throb of pleasure—
  Grand old dance, the minuet.

that distance will suffice. If it is necessary to carry stove-pipes through wooden partitions, double metal collars, three inches apart, pierced for ventilation, ought to be used, or soapstone rings three inches thick, or earthen rings two inches from the pipe, and extending through the partition. Where the products of combustion at high temperatures are disposed of, the distances from wood-work and for ventilation naturally require enlargement.

All hot-air pipes or registers should have at least four inches of solid masonry, whether of brick or stone, for outside casing, and if it is necessary to build such pipes in wooden partitions, a second and outside pipe ought to be placed around the hot-air duct, at least one-half inch distant, and this outside pipe should be three inches from the studding on each side, and the studding should be protected by tin-plate lining, while the spaces from one piece of studding to the next, and across the hot-air pipe, ought to be covered with wire-lath and plaster or slate. The partition, moreover, should be eight feet distant, in a horizontal direction, from the furnace, and if the partition is not on the same floor as the furnace, a plumb-line dropped from it should be the same distance from the furnace.

A small additional expense in using wire-lath throughout a house adds greatly to the security against fire. Besides, the powerful clinch or hold the mortar takes on the wire-lath prevents any force from detaching the plastering, which will not crack or sag. No violence can shake it down, while continued water-soaking will not detach it from ceilings.

For perfect safety, horizontal hot-air pipes should be at least six inches from the ceiling, unless protected by metal shields, when they may approach to three inches. And if they pass through stud partitions the collars previously mentioned should be employed. Under no considerations should hot-air pipes be allowed between any combustible floor and ceiling. Hot-air registers should be protected by soap-stone borders firmly set in plaster-of-Paris or gauged mortar. All register boxes should be of tin-plate, with a flange on top to fit the groove in the soapstone, upon which the register rests; there should be an open space of two inches on all sides of the register box, extending from the under side of the soapstone and through the ceiling below. This opening should be fitted with a tight tin casing turned under the soapstone, and having the lower end at the ceiling open. When a register in the floor is over a furnace, the open space should be three inches, and if this register is the only one connected with the furnace there should be no register valve with which careless persons could tamper.

Steam-pipes should never approach wood-work nearer than two inches, unless protected by a metal shield, when one inch is the limit. Covers to recesses in walls of brick or stone should be of metal, and these recesses should not be in depth more than a fourth part of the thickness of the wall, and all recesses should be built up solid at the floors.

Gas brackets should be kept at least three feet from any combustible ceiling or wood-work, unless a metal shield one-third the distance down intervenes, when half the distance will answer. All lights near window-curtains or any other combustible material should be protected by glass globes or suitable wire screens.

George Martin Huss.

THE WORLD'S WORK.

Ship Ventilation.

PASSENGERS upon ocean steam-ships who occupy state-rooms placed below the spar deck frequently resort to temporary wind-sails to secure a supply of fresh air in their rooms. While the steamer is in motion the leeward rooms cannot be ventilated thoroughly by merely opening the ports. The air passing the smooth sides of the ship does not affect the atmosphere in the rooms, and it remains comparatively quiet. The same thing happens in all the rooms in a calm, and when the wind is ahead or astern. To direct the fresh air into the room, a piece of sheet-tin or a piece of card-board may be crowded into the side of the port, leaving a part to project outside, in the form of a scoop or ear. This makes a wind-sail to throw a current of air into the room. This familiar device has been made the basis of a ventilating apparatus designed to be permanently fixed to the state-rooms of a ship. It consists of a short telescopic tube passing through the side of the vessel, and opening into the state-room near the ceiling. The movable portion of the tube is cut away on one side and closed at the end, and it may be drawn in or out by means of a handle in the room. When not in use the tube is drawn in level with the side of the ship, and it is then closed water-tight. When in use the tube is pushed out, and as the open part faces the wind (or forward) it acts as a wind-sail, catching the wind and directing it into the room. A floating valve is placed inside the tube to prevent the entrance of water in case the ventilator should be submerged by the rolling of the ship. The only criticism that can be made of the apparatus is that, while the idea is a good one, the apparatus itself is heavy and clumsy, and badly designed. Better appliances upon the same system will no doubt soon be introduced.

The idea of using the rolling motion of a ship as a means of ventilating vessels was made the subject of experiments some years ago, that were described at the time in this department. A simple and comparatively inexpensive apparatus based on this idea has now been introduced upon a number of steam-ships. On the main deck, near the middle of the ship and close to the sides, are placed two upright iron cylinders, resembling common upright steam-boilers. The two cylinders or tanks are joined together by means of a large iron pipe suspended from the ceiling of the deck below. No valves are used, so that water placed in one tank has a free passage into the other. From the top of each tank are taken smaller pipes that lead to the state-rooms, saloons, or other parts of the ship to be ventilated. These pipes are provided with check-valves opening into the tanks. Other pipes also lead from the top of each tank to the open air above the upper deck. These pipes are provided with valves opening outward. In operation, the pipe joining the two tanks is filled with water and closed air-tight, the water rising in each tank for a short distance. While the ship is at rest on an even keel no action takes place. When the ship rolls from side to side in the sea, the water flows through the connecting pipe from one tank to the other. If the right side sinks down, all the water flows through the pipe into the tank on that side. The air above the water is driven out through the escape-pipe. At the same time a vacuum is set up in the opposite tank, and under the pressure of the atmosphere the air-inlet pipes or ventilators open, and the foul air in the rooms is drawn into the tank. When the ship returns or rolls the other way the action is reversed. The water runs back into the other tank, driving out the foul air and causing the first tank to act as an inspirator to ventilate that side of the ship. This alternate inspiration and expiration is continuous as long as there is any rolling motion. The apparatus, it will be seen, is self-acting. As far as can be learned, one or two such pairs of tanks are sufficient to keep a ship of ordinary size free of foul air while the vessel is in motion.

Combined Gas Producer and Engine.

FOR places where a gas-engine may be useful, and where a supply of street gas is not available, a new combination of gas-producer and gas-engine has been devised. The aim has been to make a producer that should be cheap, simple, and easily managed, and yet capable of making a gas of sufficient richness to be of use in a gas-engine. It consists of a small vessel, lined with some refractory material, and having an opening at the top for inserting the coal. This top is closed by a cover having a rim or flange that fits into a joint filled with sand. At the bottom the vessel is provided with a fire-pot formed of inclined grate-bars. These bars rest at the top upon a circular pipe perforated with fine holes, and designed to spread a film of water over the bars to keep the apparatus cool and create a certain amount of steam. In the upper part of the producer is an annular hood, or cap, hanging down into the vessel. This serves to keep the fuel in the center of the vessel, and leaves an annular space at the top through which the products of combustion may escape. A gas-pipe joined to the top of the producer leads the gas to the scrubber, which is simply a vessel partly filled with water, through which the water bubbles upward on its way to the engine. This is all that is required for producing a sufficiently good gas for the purpose. On starting the apparatus, the producer is filled with coal and the fire lighted. At first, the products of combustion are allowed to escape through a chimney over the scrubber. Then the chimney is closed and the water is allowed to flow over the grate-bars. It is turned into vapor, and, together with a small quantity of air, enters the producer, the proper direction being given to the products of combustion by the exhaust caused by the engine in consuming the gas. The engine consists of two upright cylinders placed side by side, and having a set of valves common to them both in a circular chamber between them. There is also a reservoir for storing the gas, and a system of regenerators, formed of wire netting, for heating the gas before it is burned. On top of the engine is a small vessel, intended to hold a quantity of some light hydro-carbon for enriching the gas just before it is burned. The operation of the engine appears to be somewhat complicated. The upward movement of each piston draws a mixture of gas and air into the cylinder, and its return stroke compresses the explosive mixture and delivers it into the reservoir. The effective downward stroke is caused by admitting a portion of the gas from the reservoir above the pistons. At the same time a small portion of the hydro-carbon is added to it, and the mixture is fired by electricity. After the explosion, the waste gases pass through the regenerators into the exhaust-pipe and thus escape. The regenerators absorb a part of the heat of the exhaust, and they, in their turn, give it up again to the next supply of gas that is admitted. The engine, while it is complicated, has the merit of compactness and convenience of position, as it stands upright, and, having two cylinders, one is always doing effective work.

Portable Hydraulic Crane.

IN handling goods upon docks or in railroad yards hydraulic cranes are specially useful; but the objection that is commonly raised to them is that they are fixed and cannot be moved about. To overcome this objection, a portable apparatus has been built by mounting a crane on a platform-car designed to be used on ordinary rails. The water-main is laid between the rails along the track, and at convenient distances are placed small branch pipes. The car carrying the crane may be brought to any one of these branches and quickly connected with the main. A telescopic pipe is fitted under the car and provided with a joint free to turn in any direction, so that the connection can be made between the main and the crane at any point in reach of the sliding-pipe, and, at the same time, the crane can be turned completely round in a circle without moving the car or disconnecting the water-pipe. For such a railroad crane a small steam-pump and accumulator and the necessary pipes would be all that would be required in quite a large yard. Two cranes, one fixed and one portable, have been operated in this way in one yard, at an expense estimated at about one-half what would be required were the steam used direct in two ordinary steam-cranes.

Experiments in Horticulture.

EXPERIMENTS have been made from time to time in mulching garden plants heavily with straw, small stones, wood-chips, and other material, and keeping the ground entirely covered during the growing season. Even tiles and boards have been used to cover the ground in strawberry-beds, and in some instances a heavy coat of cement or mortar has been spread over the soil, leaving only small openings immediately about each plant or bush. More recent experiments have been made with water-proof paper, spread in sheets over the ground, between the plants, in a fruit and flower garden. The paper used was prepared by soaking ordinary kinds of paper in sulphuric acid, and then washing in clear water to remove the acid. Paper prepared in this way is known as parchment paper. The advantages gained by mulching in this way appear to be a greatly increased rapidity of growth and increased crops, with a material saving of labor in keeping the soil clear of weeds.

New Form of Sidewalk Light.

IN the iron and glass pavements used on sidewalks to light basements and cellars, the openings in the iron frame or sash are filled with small pieces of glass, usually rounded or crowned slightly on top, and flat, or perhaps slightly pointed, below. A new shape has been recently given to these glass lights that greatly increases their value. They are made flat on top, and are designed to fit tightly into the openings in the sash. Below the sash they are formed in the shape of long pendants, flat on one side and rounded on the other, and bent at a slight angle in the direction in which it is desired to send the light. In the apparatus examined the glasses, or lenses as they are called, were designed to reflect the light in a horizontal direction into the building. While all the light that could enter the room was obtained from the sky directly overhead, the amount of light obtained was remarkable. Each lens appeared to act as a silvered mirror, reflecting nearly all the light that entered the glass from above. Compared with the ordinary sidewalk sash, the amount of light admitted to the room seemed to be at least double. The design of the lenses examined seemed to be somewhat defective, yet the results obtained were good. The idea is a simple one, and if properly worked out will prove of value. Roof and wall lights are also arranged in the same way, each lens in the sash acting as a reflector to throw the light downward or horizontally as required. The lenses can be fitted to any of the sidewalk or roof sashes now in use, without disturbing the sash.

Novel Separator.

THE success attending the various forms of magnetic separators for separating iron-waste and scraps from grain and particles of iron, or from iron sands and gravels, by means of magnets, has led to the invention of a method of separating particles of gold from sand. The best of the magnetic separators have already been described here, and the new apparatus is worthy of mention only as pointing out a new direction for experiment. The separator consists of a circular pan or vessel, having raised sides and a narrow rim around the bottom on the inside, the center of the pan being open. The pan is mounted upon arms or supports that meet in the center, and are here supported by a vertical axis. By means of the proper gearing or belting the pan may be given a rapid rotary motion. Within the pan is a flat disc, also connected with the axis, so that the disc will revolve with the pan. Above the apparatus is a cover and a hopper for guiding the mixed sand and gold-dust into the machine. While at rest the pan is partly filled with quicksilver, that rests in a ring next the sides of the pan and is kept in place by a ledge on the inside. This ledge can be raised or lowered as desired by means of suitable machinery. When the machine is in motion the centrifugal force causes the quicksilver to rise in a film up the sides of the pan, and this position it holds as long as the motion continues. At the same time the ledge on the inside is lowered automatically, so that anything falling against the inside of the pan would drop through the machine into a guiding spout below. When the sand bearing the gold is placed in the hopper, it falls upon the revolving disc and is driven by centrifugal force against the sides of the pan. Here it meets the film of quicksilver, and the particles of gold are caught and held by the quicksilver. The sand merely strikes the quicksilver and falls down below. When all the sand has passed and the machine is stopped, the interior ledge is raised to catch the quicksilver as it falls back into its original position. It may then be taken out, and the gold hidden in it may be extracted by any of the usual processes. The invention is interesting as pointing the way to a new field of work in the separating of mixed materials. Reports seem to show that the first machine is a practical one, and new experiments will no doubt find still wider application of this idea of separating substances by the affinity or attraction of one material for another, when by any means they are brought together. Taking all the separators together it appears that difference of gravity, as in the centrifugal dryers and milk and cream separators, magnetic attraction, as in the iron, sand, and grain separators, and electrical attraction, as in the bran separators, have been already employed. The new apparatus suggests the use of chemical affinity to the list and greatly extends the field.

Disposal of City Refuse.

THE necessity of getting rid of ballast, ashes, and waste material collected in sea-board cities has led to the invention of a class of boats called hopper barges, in which the refuse may be carried to sea and thrown overboard. A new boat, designed to overcome the great danger and expense following the use of open floats and scows, such as are used in New York, and the great cost of iron steam-driven hopper barges, has been recently made the subject of experiments. The new boat is designed to be self-discharging and, at the same time, sufficiently large to go to sea in all weather, and to carry large loads with speed and safety. From an examination of the boat, on her return from a trip to the sea, she appeared to be well designed and roughly but thoroughly constructed. The boat consists of two parts, called pontoons, joined together in such a way as to present the outside form of an ordinary ship's hull. The stem, keel, and stern-post are in one piece, as in any hull, but here the resemblance stops. The two halves of the boat are independent of the keel, and are joined together and kept in place by three heavy wooden bridges extending across the boat from side to side. The outside of each pontoon is of the usual shape, sharp at the bow and rounded at the stern. The inside is, however, planked and calked water-tight and extends from the keel to the deck, near the outside. Thus the two parts, when in their normal position, form a V-shaped opening or well in the center of the boat and extending nearly the whole length. At each end are vertical partitions, extending from the keel up to the deck and inclosing a small space in each pontoon, that serves for cabins and lockers corresponding to the air-compartments used in metallic life-boats. Each pontoon is a complete boat in itself, and, while it would not stand alone in the water, when placed side by side, the buoyancy tends to force the lower parts together, embracing and firmly binding the stem, keel, and stern-post. At each end of the pontoons are large segments of wood, shod with iron and carrying a short piece of gearing. On the three bridges, and extending the whole length of the boat, is a shaft carrying wheels geared into the segments. There are also heavy iron rods hinged to the lower side of each pontoon, and connected with sliding bars under the bridges. Each bridge is supported on the pontoon by a journal, so that the pontoon may turn on its axis without disturbing the bridge. In using the boat it is brought to the dump, and the rubbish is shot into it till it is loaded. It is then towed to sea by a tug. On reaching the dumping-grounds, in deep water, one man standing on the center bridge between the pontoons, by the turning of a wheel unlocks the pontoons, and the weight of the load forces the two hulls apart. They turn under the bridges till the sloping sides within are vertical, when the entire load instantly drops out. The tug, meanwhile, steams rapidly ahead and drags the boat through the water, forcing a powerful current directly through it and washing it out thoroughly. The man who holds the pontoons in this position by means of the hand-wheel then releases them, and they swing together and lock themselves automatically. The whole operation takes only ten minutes, and while the tug is turning around to go home the cargo has been discharged. From an inspection of the boat at the dock it appears to be fully equal to its duty. It can be controlled by two men, one to steer and one to unload, and is sufficiently large and strong to go to sea at all times without endangering the lives of the crew. The design must be regarded as perhaps the best yet brought out, and it is capable of being applied to vessels of either wood or iron, and of any size that may be desirable. The boat examined is 34.65 meters (110 feet) long and 8.82 meters wide, and has a capacity of 500 tons.

Preservation of Wood.

THE increasing cost of wood in this country has led to a great number of experiments in preserving all kinds of wooden structures exposed to the weather from decay. Among the more recent plans suggested is one for impregnating wood with asphalt, combined with some antiseptic material. The finished wood, ready to be put together, is first submitted to heat to drive out the moisture, and is then placed in a hot bath composed chiefly of asphalt and carbolic acid. On cooling, the solvent of the asphalt evaporates, leaving a skin or coating of the asphalt on the surface of the wood that resists water and keeps the antiseptic material securely locked within the pores of the wood. The exterior of the wood presents a smooth, black surface that does not need to be painted. The process is about to be tried upon a large scale.

BRIC-À-BRAC.

Fickle Mollie.

I THINK all day of Mollie, and I dream of her all night,
Yet I'm never quite contented even when she's in my sight;
For 'tis, "Ah, I love you, Jamie!" and 'tis, "Ah, I love you not!"
Until, pretty, fickle Mollie, I wish you were forgot.

She's a fair and lovely creature, the sweetest of her kind,
If she'd only be consistent, I ne'er a fault could find;
But 'tis, "Ah, I love you, Jamie!" and 'tis, "Ah, I love you not!"
Till I swear, O fickle Mollie, I wish you were forgot.

My heart is tossed this way and that, my feelings ebb and flow,
Till, wild with joy and mad with pain, I know not where to go;
For 'tis still, "I love you, Jamie!" and 'tis still, "I love you not!"
Till I vow that fickle Mollie by me shall be forgot.

Oh! Mollie, Mollie, Mollie love! why will you tease me so?
For you I never can forget, your love can ne'er forego:
And though you love me, Mollie, and though you love me not,
Full well you know, O Mollie dear, you'll never be forgot.

Jennie E. T. Dowe.

THE WORLD'S WORK.

New Steam Motor.

THE demand for small and easily managed motors has led to the introduction of a great variety of low-power steam-engines. All of these new motors that have proved of real value in business have been already described from personal examination in past numbers of THE CENTURY. To this list may now be added a new double-cylinder, single-action engine, that seems likely to prove of use wherever it is difficult to obtain skilled labor. The engines examined were of only four and eight horse-power, as machines of only moderate size have yet been erected. Each engine, whatever its size, has two upright cylinders placed side by side upon a hollow cast-iron pedestal or case, that is designed to hold the crank-shaft and all its connections. Between the two steam cylinders is a smaller cylinder designed to hold the slide-valve that controls the inlet ports of both cylinders. This valve is of the common D pattern moving in a cylinder and having below it a piston placed on the eccentric rod, and serving to prevent the escape of steam from the valve-chamber. Steam enters the valve-chamber, and is admitted by the valve through very large ports into the top of each cylinder in turn, the effective stroke being downward. The exhaust steam escapes from each cylinder through a series of openings all round the lower part of each cylinder, the descent of the piston itself uncovering the exhaust-ports and permitting the steam to escape into an annular chamber surrounding each cylinder. From this chamber the exhaust passes through openings in the lower part of the valve-chamber to the open air. This arrangement of parts gives the engine the appearance of a three-cylinder engine, and as all the working parts are inclosed in the hollow pedestal, nothing is visible on the outside except the cylinders and their support. The piston in each cylinder is connected directly by means of one rod with the crank-shaft, the two cranks being balanced one against the other. The eccentric rod is also connected directly with the piston in the valve-chamber and with the valve. The chamber or hollow pedestal in which all these parts are placed is water-tight, and is designed to be filled up to the level of the crank-shaft with water. On this water is poured a film of oil. The operation of the engine may be easily understood. Steam is admitted to the top of one cylinder, and the piston is driven downward till it uncovers the annular exhaust-ports. Steam is then admitted to the top of the second cylinder, and its effective stroke brings the first piston back to its place. The motion of the cranks in the oil and water dashes them into oily foam that covers every moving part of the engine. The spray of mingled water and oil lubricates all the bearings inside and the bearings of the shaft on each side of the pedestal, a small portion escaping outside, where it is caught in a drip-pan. An inlet is provided for filling the pedestal with oil and water, and a glass tube is placed at the side to show the height of the water inside. The simplicity of the general design of the engine, its limited number of parts, and the arrangement for securing the self-lubrication of all the parts, are points in its favor. The machines examined appeared to run at a high speed in silence, and with great steadiness. As all the moving parts are balanced and kept inclosed in a spray of mixed oil and water, the motor requires no particular skill in management.

Recent Progress in Photography.

THREE new cameras, a lantern for the dark room, and some novel photographic processes, have recently been introduced. One of the cameras is intended to be used in taking a series of instantaneous photographs of a moving object, such as a flying bird, etc., in rapid succession. The lens is placed in a telescopic tube that is to be held in the hands while the end, or stock, rests upon the shoulder. At the end of the tube is placed a circular holder having a series of openings that may be brought in turn in line with the tube, precisely as the chambers of a revolver are brought into line with the barrel of the revolver, by the turning of the holder on its axis. The sensitive dry plate is placed in this holder, and each movement of the holder brings a portion of the plate under exposure in the tube or camera. In use the camera is focussed as nearly as may be on the path of the bird, and the instrument, or, as it has been called, the photographic gun, is aimed at the bird as it flies. The pictures are taken in rapid succession in what amounts to one exposure. It is of no consequence that the bird may be more or less out of focus, for as long as an image or silhouette is obtained the pictures will serve to illustrate its flight or the action of its wings. The movement of the circular plate-holder and the exposure is controlled by simple clockwork attached to the apparatus.

The other camera is of more general use, and is an ingenious application of a common opera or field glass to photographic purposes. In the apparatus examined, a field-glass of convenient size forms the camera. The lenses of the glass were in place, so that it could be used in the usual way. On taking these out and substituting two lenses at the smaller ends of the glass, it was transferred into a double camera. Over one of the larger ends was then slipped a cap having a sheet of ground glass. On holding the glass in the hand and looking at the ground glass the picture could be seen as in any camera, and to adjust the focus it was only necessary to move the screw in the usual way. A small metallic plate-holder having a sliding shutter and containing a single instantaneous dry plate was then fitted over the larger end of the other tube. The opposite end has a snap-shutter kept closed by a spring, and on drawing the shutter of the holder the camera was ready for exposure. As the views are taken in a small fraction of a second, the camera may be held in the hand toward the subject, and, when it is seen on the ground glass to be in the field, the exposure is made by snapping the spring-shutter with one finger. While the pictures taken in this camera are only five centimeters in diameter, they are sharp and clear, and can be easily enlarged by copying in a lantern. With the camera is a cloth muff or tent for the hands, so that by placing the holder and a dry plate wrapped in black cloth in the tent the plates can be changed without going into a dark room. Each plate is previously wrapped in black cloth. The hands are inserted in the muff or tent, and the work is done by feeling. A little practice will enable any one to do this, and it would seem that the tent might be useful in changing plates in ordinary plate-holders. To exclude the light, elastic bands at the ends of the muff fit tightly over the wrist. The field-glass and its lenses, the holder, dry plates, and hand-tent are packed in a small hand-bag, the whole apparatus weighing only about two kilos. The camera seems to be one that may be useful for reporters, detectives, and tourists who wish to make photographic records of scenes and events upon their travels.

In making photographs of microscopic objects, it has been thought necessary to use the light of the sun, and for this reason it has been the custom to use some kind of heliostat to bring the light into the camera. By a novel arrangement of the lantern here described it is now possible to photograph any object seen in a microscope, and by means of any cheap form of camera. In the apparatus examined, a good negative was taken in ninety seconds upon a dry plate, one half-size, by the aid of a lamp and a camera costing only about ten dollars. A long and narrow board was made to rest on rubber balls, in order to deaden vibrations from the table on which it was placed, and on this was set up the lantern, with the door at the side open. In this door was placed a wooden shield holding a single lens condenser. Directly in front of this was placed the microscope stand with the tube laid down horizontally. The stage holding the object to be photographed was brought close to the condenser so that the light would pass directly through it. The eyepiece was then taken off the microscope, and a roll of blackened paper was slipped inside the tube to destroy the reflections from the sides of the tube. The camera with the lens taken out was then placed behind the microscope and a blackened tin tube was placed between them to cut off the light, the annular space between the tube and the microscope being covered with a sleeve or curtain of black cloth. This apparatus was the first ever made, and it is proposed in other instruments to make the tin tube between the microscope and camera fit tightly, so that no curtain will be needed. When the parts had been arranged in this manner, and the lamp lighted, the object on the stage of the microscope appeared on a greatly magnified form on the ground glass of the camera. To adjust the focus it was only necessary to fix the focus of the microscope. On exposing a dry plate in the camera, a good negative was obtained that on development was ready to be used in printing.

The new dark-room lantern is intended to hold a large oil-lamp inclosed in a tin box or lantern about 30.5 centimeters (12 in.) square. The back of the lantern has a sliding-door to give access to the lamp. There is also a door at one side. This door is closed by a sheet of porcelain or opal glass, that may be covered by a tin door on the outside. The front of the lantern projects a few centimeters at the top, and is glazed with a large sheet of ruby glass. There is also a movable hood or cover over this to shade the eyes and throw the light downward. A reflector is also placed behind the lamp inside the lantern. In the dark room the lantern gives a strong, pure ruby-light, and when it is desired to expose a plate to white light, as in making lantern slides, the side door is opened and the printing frame is held before the opal glass.

Among photographic copying processes recently reported is a plan for reproducing pictures on silvered glass. Ordinary mirrors are covered on the silvered side with a film of sensitized bitumen. The glass is then placed under a negative and exposed to the light. After the exposure the bitumen is washed with oil of turpentine, and the parts not affected by the light are washed away. This leaves the picture in hardened bitumen on the back of the mirror. The silvering is then washed with nitric acid, which removes all not protected by the bitumen.

In photo-engraving processes a new formula is announced for taking impressions from gelatine films. Sheets of polished metal are prepared by covering with gelatine sensitized with bichromate of potash. This is exposed under a negative to the sun in a printing-frame. The film is then washed with water to remove the surplus gelatine that has not been fixed or hardened by the light. An alloy of bismuth, tin, and lead is then prepared and poured while quite liquid into a special vessel or flask, and the metal plate with the gelatine film is laid over it and submitted to pressure. The alloy takes the impression from the film, and when cold it may be used as an engraved block in printing. It is also said that the new alloy, known as "Spence's metal," may also be used in this way, as it sets or hardens before the gelatine film can melt.

BRIC-À-BRAC.

Triolets.

AN APOLOGY FOR GAZING AT A YOUNG LADY IN CHURCH.

THE sermon was long
And the preacher was prosy;
Do you think it was wrong?
The sermon was long,
The temptation was strong,
Her cheeks were so rosy,—
The sermon was long
And the preacher was prosy.

REJECTED.

YOU'VE spoken of love
And I've answered with laughter;
You've kissed my—kid glove,
You've spoken of love,—
Why, powers above!
Is there more to come after
You've spoken of love
And I've answered with laughter?

Self-acting Fire-door.

A NUMBER of experiments have been made in this country to test the value of different materials for doors that may be exposed to fire, from which it appears that perhaps the best door yet devised is one made of wood and covered with tin. The door is formed of solid planks or boards matched and fastened together and crossing at a right angle, or at forty-five degrees. There should not be less than two thicknesses in any door, and as many more should be used as the size of the opening to be closed demands. This solid wooden door is then to be completely covered on every side with tinned sheet-iron, all the joints being soldered as in making tin roofs. The tinned door is supported by hangers moving on an inclined rail or track over the door-way, so that when free to move it will close by its own weight. At the door-jamb opposite the door when it is open should be a wooden casing covered on every side with tin, and into which the door will fit tightly when it closes by moving on its track, the inside of the casing being wedge-shaped. The casing on the opposite side must fit the door closely so as to leave no cracks at the sides of the door. To keep the door open a small bolt is placed on the inside of the door-jamb, the pressure of the door keeping the bolt in position. On the under side of the arch or top of the door is a wire having a joint or link in the center, this link being soldered with fusible metal that will melt at one hundred and sixty degrees Fahrenheit. Just above the bolt that holds the door open is a weight supported by a wire connected with the wire holding the fusible link. This weight moves in guides and is wedge-shaped below. The threshold of the door should be of brick or stone to resist fire, and high enough to keep out water in case the room is flooded. From the reports and experiments it appears that such a door is thoroughly reliable, the soft metal link parting even in the heat of a fire in a building on the opposite side of the street and allowing the weight to fall, pushing the bolt one side and permitting the door to close. Such wooden, tin-covered doors and window-shutters are reported to stand unharmed through severe trials when iron doors have failed, melted, or warped under less exposure to fire. The door and the automatic device for closing it is officially recommended by some of the leading fire insurance companies of this country.

AUTOMATIC SPRINKLERS.

THE automatic sprinklers now coming into general use among the textile manufactories in New England appear to have fairly passed the experimental stage. Three patterns have been tested thoroughly, and have proved of great value. A tank is placed in the upper part of the building, be it mill, factory, or theatre, and from this tank wrought-iron pipes are laid to all parts of the building. The pipe system is so arranged that every part of the floors on each story is in range of a rose nozzle or sprinkler on the pipes. To accomplish this the pipes are suspended a few centimeters below the ceilings, and at intervals are placed sprinklers, each one designed to deliver a spray of water that would drench the ceilings, walls, and floors within a certain distance. The number of sprinklers must be sufficient to allow the sprays to overlap and cover the entire surface of the floor. The sprinklers are closed by thimbles, valves, or other devices for preventing the escape of the water, each one being kept in position by a soft solder that melts at a comparatively low temperature. The only difference in the systems that have been tried appears to be in the form of rose or sprinkler, and the shape of the automatic locking device. Any one will open automatically under the influence of a very slight rise in the temperature. The heat of a few burning shavings on the floor of a room will open any sprinkler near it, and the spray of water delivered by one is sufficient to put out any fire that could be started under or near them. The tank and pipes are to be kept full of water at all times; any loss of water caused by the sprinklers being brought into action by fire or by leakage causes a float in the tank to fall, and by means of a cord releasing an alarm clock-work that rings a bell or sounds a whistle. These automatic sprinklers, whatever the merits of each variety, have now proved their value and usefulness.

Improved Stereoscope.

TO CORRECT the distortion of vision sometimes experienced by persons using the common forms of stereoscopes, there is always a more or less conscious effort on the part of the observer to control the muscles of the eye and to accommodate the sight to the instrument. This leads to weariness and sometimes pain in the eyes, and to obviate this an improved stereoscope has been brought out that may be adjusted to the sight of each person using it. The two half-lenses, that in the ordinary stereoscope are fixed in a frame, are quite loose and are supported in a flat wooden box having openings at the front and back. Each half lens is placed in the box by lifting the cover, and is held upright by the sides of the box. In the center of the box is a partition, and to each side of this is fastened a flat brass spring that presses against the thin edges of the lenses and tends to push them apart. At the ends of the box are screws to be moved by hand from the outside. By turning these screws the lenses may be pushed close up against the springs, while, by releasing the screws the springs push the glasses back again. By this simple arrangement which, while it is not wholly new, is here made of practical value, the stereoscopic lenses can be moved nearer together or farther apart to suit the eyes of the person using the instrument. When adjusted to the sight the stereoscope can be used for a long time without fatigue, as there is no effort required to cause the two images to mingle into one. The screen between the two glasses on the frame of a stereoscope, and designed to shut off a part of each of the pictures, is in the new instrument made of brass in the form of hinged wings that can be folded and bent back against the glasses. In ordinary use the screen is kept open in the usual position. By folding it back and by taking out the half-lenses and substituting for them a pair of thin glass prisms, the stereoscope can be used in another way. Just behind the glasses is set up a second screen having an opening in the middle. This cuts off from each eye the picture directly opposite to it. In other words, when the prisms are used, and the first screen is folded back and a second screen put up, the right eye sees half the left-hand picture, while the left eye sees only one-half of the other picture, the picture in front of each being shut out. This arrangement gives a reversed image, and, with the right kind of stereographs, gives stereoscopic effects of a novel and most interesting character. This and some other applications of the new instrument have proved of great scientific interest, while the new accommodating lenses give value to the instrument in general stereoscopic work.

The Use of Lime in Breaking Down Coal.

It has long been known that, if caustic lime be wet while confined in an inclosed space, considerable heat and pressure will be developed. From experiments recently undertaken it seems this may be of value in coal-mines and stone-quarries. Lime of a good quality is compressed into small cylinders under hydraulic pressure, each cylinder having a groove along one side. The holes are drilled in the coal precisely as if for blasting with powder. Iron pipes having a groove along one side are then placed in the drill holes to serve as holders to keep the cartridges of lime dry. Perforations are made in the ends of these pipes, and each one is covered, before it is put in the drill hole, with a case or bag of cloth designed to keep the water out of the pipe while it is being charged. The cartridges of lime are then placed inside the tubes and tamped. Water is then forced into the tubes by means of a hand pump and hose. It follows the groove in the pipe and passes through the cloth bag, wetting the lime cartridges. As soon as the air is driven out the tubes are closed, and the hose is removed. Steam is generated in the pipes, and as it cannot escape, an explosion soon follows. The expansion of the lime follows soon after, and under this double pressure the coal is soon broken down. There is no smoke or fire, and the work is reported to be both rapid and effective. The experiments, which appear to have been satisfactory, were made in a coal-mine where, on account of the amount of gas in the coal, powder could not be used.

New Decorative Process.

A novel system of staining wood has been introduced that has the merit of simplicity and cheapness. The wood having been carefully planed and finished, is given two thin coats of sizing. This is prepared by adding to glue a small quantity of albumen and alum. When this is dry and hard the design is painted or stenciled upon the wood. The intention being to produce a pattern, one part of which shall be of the natural color of the wood, the stencil or the design selected representing the white parts only. For instance, if the finished work is to show white figures on a dark ground, the white parts only must appear in the stencil. When the sizing is dry the pattern is painted on in Canada balsam or Brunswick black. When the balsam is hard and dry the whole surface is washed with a sponge and warm water. This will remove the sizing from all those parts of the wood not protected by the hard balsam, which resists the warm water. When the wood is dry the exposed parts are stained in imitation of walnut or other dark woods. When the staining is finished the balsam is removed by brushing it with turpentine, leaving the pattern or design in the natural color of the wood on the dark, stained ground. The finished work is said to resemble closely inlaid wood.

New Traction Engine.

The two difficulties that appear to be encountered in making and using traction engines are the want of power and the want of adhesion. To make a powerful engine that will drag heavy loads over common roads implies the use of a large boiler, and this implies weight. On soft ground the wheels of these heavy engines slip, and the motor comes to a stop. In a new engine recently examined an effort has been made to get over these difficulties by the use of a light tubular boiler with compound engines and a new form of driving-wheel. The motor consists essentially of a hollow frame supported on four wheels, and carrying one boiler and three double engines. This frame is of plate iron, and is designed to serve as a water-tank. The two driving-wheels are 1.89 meters in diameter, and with a face, or tread, of 63 centimeters. Each wheel is independent, and turns on a short journal that rests at one end on the frame of the engine, and on the other upon a bar that passes along the front, resting on the frame at each end. By this arrangement each wheel is inside the frame very much as the paddle-wheel of a river-boat is placed within the deck of the boat. The two forward wheels are joined together, and form the leading-wheels. They are carried upon a truck that is free to turn under the forward part of the frame, and is controlled by a hand or steering wheel. The boiler, which is placed between the two driving-wheels, is composed of sections of double tubes built up over the fire-box. Each tube is composed of two parts. The larger tube is for water, and is exposed directly to the fire. The smaller tube inside this is the return flue for the smoke, so that the water is in an annular space, with the flame on both sides. The boiler is of great strength, and is designed to furnish steam at a working pressure of about four hundred pounds. The engines are placed on the frame on each side of the boiler, and next to the driving-wheels. Each engine is independent, and controls one wheel. The cylinders are double, though they look like single cylinders with three piston-rods, one at one end, and two at the other end. The smaller high-pressure cylinder is placed inside the larger cylinder, and has one piston and rod. The low-pressure cylinder is annular in section, and has a ring-shaped piston and two rods turned in the opposite direction from the first piston-rod. This novel form of engine has already been described here. (See page 795, Vol. I., New Series.) The engines are connected with cranks that turn small geared wheels that turn in a geared rim on the inner side of the driving-wheels. The high-pressure cylinder is designed to take the steam at a pressure of four hundred pounds, and to discharge directly into the low-pressure cylinder; and the exhaust finally escapes into the open air through the smoke-stack or into the water-tank directly under the engines. At the rear of the motor is a pair of small hoisting engines that are intended to assist in handling the gang of eight plows to be drawn behind the engine. It will be seen that by the use of a tubular boiler and high pressure the engine can be made very small, and in this way a great saving of weight, together with high power, is gained. To secure adhesion in wet and soft ground a broad tread is given to the driving wheels, and a novel system of shoes is employed. Hanging from the hub of each wheel is a pendulum free to swing inside the wheel. At the end of this is a small wheel just touching the inside of the large wheel, and turning with it. In this wheel are hung loosely a number of teeth or claws. On the face of the large wheel are cut a series of holes slightly larger than the teeth on the small wheel traveling inside. As the engine moves this smaller wheel is made to turn with it, and the teeth in turn drop through the holes in the face of the driving wheel, and catch in the ground. In this manner the driving-wheels are practically shod with shovel-shaped teeth that dig into the ground, and holding fast prevent the wheels from slipping. By this device the motor has a good traction, and can be used on sandy roads or upon soft plowed land. When the engine is to be used on hard roads, and the teeth are not needed, the smaller wheel turning inside the drivers can be raised above the ground, or the teeth can be taken out. In either case the small wheel revolves idly without impeding the engine or cutting up the road.

BRIC-À-BRAC.

To an Obscure Poet who Lives on my Hearth.

WHY shouldst thou cease thy plaintive song
When I draw near?
Has mankind done thee any wrong,
That thou shouldst fear?

To see thee scampering to thy den,
So wild and shy,
'Twould seem thou knowst the ways of men
As well as I.

'Tis true the palmy days are o'er
When all thy kind—
Poor minstrel folk—at every door
Might welcome find;

For song was certain password then
To every breast,
And current coin that bought from men
Food, fire, and rest;

And these are more discerning days,
More coldly just;
I doubt thy rustic virelays
Would earn a crust.

The age is shrill and choral-like,
For many sing;
And he who would be heard must strike
Life's loudest string.

And thou, poor minstrel of the field
With slender tone,
Art type of many a singer sealed
To die unknown,

And many a heart that would have sung
Songs sweet to hear,
Could passion give itself a tongue
To catch the ear.

But, cricket, thou shouldst trust in me,
For thou and I
Are brothers in adversity—
Both poor and shy.

And since the height of thy desire
Is but to live,
Thy little share of food and fire
I freely give.

And thou shalt sing of fields and hills
And forest streams,
Till thy rapt invocation stills
My troubled dreams.

Charles L. Hildreth.

Sweet Phyllis.

A PASTORAL.

WITH cowslips in her flaxen hair,
In straightly hanging gown o' blue,
A crook within her lily-hand,
A silver buckle on her shoe,—

She sits upon a daisied bank,
Her fleecy flock are feeding near;
Her heart calls over, like a bird:
"Oh, Colin, Colin, Colin dear!

"My love a blue-eyed shepherd is,
He leads his flock on yonder lea;
I am a simple shepherdess,
But Colin came awooing me!"

Dear Colin stands amongst his flock,
And stares across the meadow-gate;
He sees sweet Phyllis' gown o' blue,
And leaves his lambkins to their fate.

"Oh, Colin, Colin, Colin dear!"
Sweet Phyllis hears her heart repeat.
She starts and blushes, for she sees
Her own dear Colin at her feet.

A pattering of little hoofs,
Through meadow-grasses crisp with dew,
A bleating at the meadow-gate,
And Colin's sheep are coming too.

Mary E. Wilkins.

is condensed and classified; each division being supplied with questions to aid the teacher.

This manual was submitted in manuscript to the Bureau of Education at Washington, as well as to many prominent educators elsewhere, with reference to its introduction into public and private schools, and received the hearty approval of them all. A very favorable report was issued by the Commissioners of Education in 1878. *S. B. H.*

Jenny Lind's Courtship.

"I AM a Quaker, as you know," a Philadelphian recently said to me, "and it is reported that, shortly before Jenny Lind's visit to our city, an aged lady arose in one of our meetings and said she had heard that 'Jane Lyon, a very *wicked woman*, was on her way to this country to sing,' and she hoped that none of the young people would be drawn away to hear her. Nevertheless, an uncle took me and my brother to the Saturday matinee. We had seats in the balcony and so near the stage that we could in a way see behind the scenes. Early in the entertainment Jenny Lind sang, 'Home, Sweet Home,' and the audience was beside itself. Among the members of her company was her future husband, Otto Goldschmidt. He was to the audience simply an unknown pianist, and to be obliged to listen to anything but the voice of Jenny Lind was provoking. Well, the man played, and from where we sat we could see Jenny Lind behind the curtain listening most intently. When he had finished, the audience seemed in nowise disposed to applaud; but Jenny Lind began to clap her hands vigorously, observing which, we boys reënforced her, and, observing her face light up — I can see the love-light on it yet — we clapped furiously until the applause spread through the audience. When he had finished playing a second time, my brother and I set the ball in motion, and the applause was great enough to satisfy even the *fiancée* of Otto Goldschmidt."

M. W. F.

THE WORLD'S WORK.

Shop Conveniences.

A NUMBER of inventions have been recently brought out that are designed to save labor in shops and retail stores. The aim has been to find some means of conveying small parcels and packages from one part of the store or building to another without the aid of "cash" or elevator boys. The first of these examined was an elevator in an open well extending from the basement to the top of the building. At opposite corners of the well are wrought iron guides for the elevator platform or car. This car consists of a simple box, open on all sides and supported by a single wire rope. This rope, after passing over a wheel at the top of the well, returns to the basement where it is wound round a steel drum. This winding drum is controlled by gearing from a simple belt-shifting device, the power being delivered by means of a belt from the engine in the building. Connected with the winding drum is a brake for controlling the elevator and keeping the platform firmly suspended at any desired point. It is not intended to carry anything more than light freight. The usual chain or wire rope used to control the movement of elevators is replaced by a steel rod extending the whole length of the well. At every floor an arm is pivoted to this rod so that, by moving any one of the arms, the rod can be moved up or down sufficiently to control the winding drum. At every floor there is also a horizontal arm or lever having a gear at the end in the form of a segment of a circle. This gear is fitted to gears on the rod. By this arrangement the rod can be turned on its axis from every floor. Just above each floor there is placed on the rod a "dog" or stop. By turning the handle on any floor the rod can be rotated till one of these stops projects outward into the well. To understand the operation of this novel form of elevator, we may suppose the car is at the first floor and is filled with goods intended for the fifth floor. The attendant moves the horizontal handle over a graduated scale until the figure five is reached. In this position, all the stops on the rod are turned away, except the stop at the fifth floor. The starting handle is then moved, and the car ascends with its load. It passes clear of all the stops until the fifth is reached, when the car catches in the stop and by its upward movement lifts the rod. This movement shifts the belts and puts on the brake, and the car stops. At the same time an alarm is sounded to give warning that the car has arrived. Perhaps the next trip is down to the second floor. The lever is moved over the scale to the figure 2, and the starting lever is moved. The movement of the rod releases the brake and shifts the belts below at the same time. The car descends and is stopped as before. The elevator has already been put in a number of shoe-shops and other light factories.

In large retail stores where a great variety of goods are sold in one building, it has been found necessary to employ children to carry the money to the cashier and to take the goods to the packing and delivery departments. To get rid of the expense and inconvenience of having so many "cash" boys and girls in such stores, a number of inventions have been brought out, designed to act as substitutes. The most simple of these is a light iron rail suspended from the ceiling of the store over the counters. On this rail run small two-wheel cars, each intended to carry a receptacle for money or parcels, or both. The salesman, on receiving the money for the goods, puts it in a car on the rail overhead, and it rolls by gravity down the rail to the cashier's desk. Here the car is taken off and the change is made and put in it, and the car is placed upon another rail and returned to the salesman. When there are a number of salesmen on one line of rails there must be some means of stopping each car on the return track at the right salesman or "station." To accomplish this there is at each station a graduated stop so arranged that it allows all the cars intended for stations beyond to pass, and stops the one intended for that place. How this may be accomplished will be made plain in describing other kinds of cash carriers. This system, it will be seen, is simply an adaptation of the common wire rope transport system often used in handling coals and minerals in mines and yards. In the system examined there seemed to be no provision for guiding the cars from one track to another or to branch tracks, a boy being employed in every case to lift the cars off one line and transfer them to another.

The familiar pneumatic dispatch tube system has already been used in one store in this country for conveying the money from the various departments to the cashier's desk. Two brass tubes are arranged overhead from each counter to the cashier. Each is connected, by means of another pipe system, with the blowers or exhaust fans. By means of suitable power a strong blast is drawn through all the pipes, and the money inclosed in small cylinders is blown through them. The system examined did not appear to differ from the ordinary pneumatic tubes and, while it is much more rapid than the system just described, it did not offer any special advantages. The stations were too far apart, and the multiplicity of pipes unsightly and inconvenient. For long distances and where light goods are to be moved from one building to another, the pneumatic system has one advantage over any railway depending upon gravity for a motive power, as the tubes can be carried under streets or over the roofs and through narrow passages where a railway would be impracticable.

Perhaps the most complete and convenient system of carrying cash from one part of a store to another is a new one based on the simple form of tram-way used in bowling alleys to return the balls to the players. The carrier consists of a hollow wooden ball cut in halves and provided with a simple device for locking the two parts together. Inside each half is a coiled spring supporting a metallic disk. The cash is put in one half of the carrier and the two parts are locked together, the money being firmly held between the two springs so that it cannot rattle or move about as the carrier travels on its track. There are, in this system, two tracks suspended from the ceiling directly over the counters in the store. In the examples seen, these tracks were in some instances placed one over the other, or side by side as the case required. They passed by easy curves from one part of the store to another and had a number of branches or switches, and even extended by means of elevators from one floor to another. To understand the working of the system it must be noticed that the outward track, from the counters to the cashier's desk, was, as far as possible, arranged in a single line. At intervals along the counters are small elevators. These consist of two metal rods hanging down from the ceiling and serving as guides for a car that may be raised by pulling a cord. The salesman, on receiving the cash, puts it in one of the hollow balls designed and numbered for that station, and places the ball in the elevator. The bottom of the elevator is inclined, and the ball would roll out were it not for a latch that bars the lower side of the elevator. On pulling the cord the car is raised till it meets the track overhead. Here the latch is automatically opened and the ball drops out upon an inclined plane. It rolls down this plane to the track, and starts upon its journey. This plane is pivoted, and when at rest is horizontal and does not touch the track. When the ball falls upon it the weight throws it down and it assumes an inclined position and gives the ball an impetus at the start. At the same time, other balls moving on the track from stations above pass under the plane without hindrance. When the carrier reaches the cashier it is taken off, and the change is made and returned to the ball. The inward and outward tracks are in convenient reach of the desk, and the cashier has only to transfer them from one track to another. On the inward track all the carriers are going to one place. On the outward track there may be, say, eight carriers going to eight different stations. To send each carrier to its own place the balls are of different sizes, the largest ball intended for the first station, the smallest for the last. At each station is a switch in the track, a portion of the track being pivoted so that it will open and allow the ball to drop into a basket suspended under the rails. Each of these switches is locked, and cannot be opened except by the passage of the ball intended for that station. Over the track at each station is a stop or guard, each being of a different height above the rails. When the largest ball intended for the first station meets the guard it strikes it, and this blow releases the lock on the switch. The ball enters the switch and forces it open by its weight and drops into the basket below. All the balls for stations beyond pass under this guard, and, as the switch remains closed, they pass over it to their destination. In the same manner the switches for guiding the balls upon branch lines are controlled by the balls: all the balls of a certain size opening the switches and taking branches, while all the smaller balls pass under the guard and keep on the main line. For transferring the balls from one floor to another, the elevators are used to lift them to the upper track system while they are allowed to drop through pipes to the tracks below. This system has already been introduced into a large number of retail stores.

Closely allied to this invention is another, intended to be used on horse-cars as a substitute for a conductor. An inclined plane is placed at the side of the car, down which the coins paid for fares roll into the cash-box. The plane is protected by glass to keep the coins on edge and to serve as guides. Openings are arranged at intervals into which the fare may be dropped. The motion of the car assists in rolling the coins along the track.

To transport light goods from one part of a store to another is far more difficult than to merely send money. A new apparatus, recently made the object of experiment, seeks to accomplish this by means of an endless belt driven by steam or other power. The belt is intended to be placed over the counter or under it, as may be most convenient. In the store inspected it is placed above the counter and behind the goods hung up for display. The belt is made to travel in one direction at all times, and is kept within wooden guides that also serve for ways or tracks on which light boxes or carriers may slide. At intervals on the belt are brass stops pivoted in such a way that in passing on either the upper or lower side of the belt, and in passing round the wheels that move the belt they always maintain an upright position. On making a sale and receiving the money the salesman puts the cash and the goods in the carrier, and then places it on the upper track. The belt passes under it until one of the stops approaches, strikes the carrier, and pushes it along the ways toward the cashier's desk. At the side of the carrier is a piece of stout wire forming a projection or handle. This is fitted to each car in a different position. On reaching the end of the line this projection strikes an arm or stop beside the track, and the carrier is tipped over and falls off the line into a basket. After the change is ready and the goods packed, they are put in the carrier, and it is placed on the other track to be returned to its proper station. At each station the stop is placed in a different position. All the carriers intended for stations beyond pass without detention, and the car intended for that place is turned aside and thrown off into a basket beside the track. In this system the belt is moving continually and the outgoing carriers are placed on the track at any place desired. No elevators are required to lift the carriers to the track, and the tracks may be level. On the other hand, the track must be straight and there is no provision for turning a corner or for branch lines. The apparatus examined worked well and was reported to require only a moderate amount of power.

Improved Damper Regulator.

In the management of stationary boilers, whether they are designed for heating or power, it is important to regulate the draft of the fire so as to keep the heat and pressure constant. Various contrivances for making the steam pressure regulate the draft have already been tried with more or less success. Among the most recent of these is a steam damper regulator that appeared on inspection in actual operation to work with an unusual degree of precision. The apparatus consists essentially of a steam cylinder and piston that controls the damper in the chimney and is itself controlled by a safety valve. The regulator is designed to be placed on a bracket on the wall near the boiler, and is connected with it by means of a steam-pipe. At the bottom of the regulator is a valve controlled by a lever on which a weight may be hung at any point desired. When the steam pressure reaches the point where it can move the valve by raising the lever, it enters the interior of the cylinder. The piston is fixed, but the cylinder is free to rise. The upward movement of the cylinder allows a cord fixed to the top to rise, this cord controlling the damper in the chimney. A weight is fixed to the handle of the damper and so arranged that as soon as the cord is released the damper is closed. The fire at once slackens and the steam pressure falls below the point where the lever is fixed. The valve then closes and the steam in the cylinder condenses, and the weight of the cylinder causes it to fall, and this in turn opens the damper again. While the details of the operation appear complicated, the apparatus is really quite simple. Those examined appeared to be in constant motion, and to be susceptible to very slight changes in the pressure. The regulator, by means of the weighted lever, can be adjusted to any required pressure according to the demand for steam.

New Steam Pump.

In a new steam pump recently designed the aim has been to simplify the valve-movement. The movement of the piston in the steam-cylinder is controlled by a slide-valve placed in a smaller cylinder and also by a small piston that moves freely in the cylinder. Steam is admitted alternately to the front and back of this piston by means of a second and smaller slide-valve that has a vertical motion within a small steam-chest. The movement of this second slide-valve is controlled by means of a plug that rests directly on the piston-rod of the pump.

On the piston-rod is a ring-shaped depression, and the plug, resting on the rod, drops into this as the rod moves forward and backward. At the beginning of the stroke it rests on a shoulder at the end of the rod. As the rod moves the plug slips off this shoulder and moves the slide-valve. The piston-rod moves under the plug till the depression is reached, when the plug drops into it and again moves the valve. By this simple arrangement the piston-rod of the pump directly controls the valves independently of any eccentric. While this idea is said to be quite new, it has been applied for some time to both steam and air-driven rock-drills. In a rock-drill driven by steam, and where the secondary slide-valve is fastened to a plug resting on the piston-rod of the drill, the operation of the valves seemed to be all that could be desired. In the drills the piston-rod is beveled, and the plug rests on the inclined or beveled portion, so that it may be moved whether the stroke is long or short. The slide-valve is also controlled by a helical groove on the plug, so that by turning the plug round by means of a lever on the top, the amount of steam admitted by the slide-valve may be placed under complete control. This system of valves has been in use in rock-drills for some years, and appears to be quite successful. There seems to be no reason why it may not be equally successful when applied to steam-pumps.

Progress in Gas Lighting.

The experiments that have been made to improve the lamps used in burning gas have apparently taken two directions. One may be called the regenerative system, and the other the incandescent. The regenerative lamps, already described here, are now made with cages or cones of some refractory material like lime or magnesium wire. The air for combustion is raised to a high pressure, and both gas and air are heated by a small gas furnace separate from the lamp. The flame is directed against the cage of wire, and it is heated till it gives more or less light by incandescence. The incandescent lamps depend more on the heated material for light than on the gas itself. A Bunsen burner is arranged to spread its hot non-luminous flame over a cage of platinum wire. The air for combustion is not heated, but is supplied to the lamp under a moderate pressure. When first lighted this form of lamp gives very little light, with only a noisy, flickering blue flame. When the platinum wire becomes white hot, a soft and steady light of great intensity is obtained.