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.