greenness of herbage when the dry seasons are on, will show where water can be found. Films of vapor or mist usually arise over ground that contains a supply of water underneath and will hang on and continue to be of greater density than the vapor rising from the surrounding land for some time after sunrise. If we are on a dry, sandy plain there will also be swarms of insects moving about over the section where water is stored underneath, at the first appearance of the rising sun.

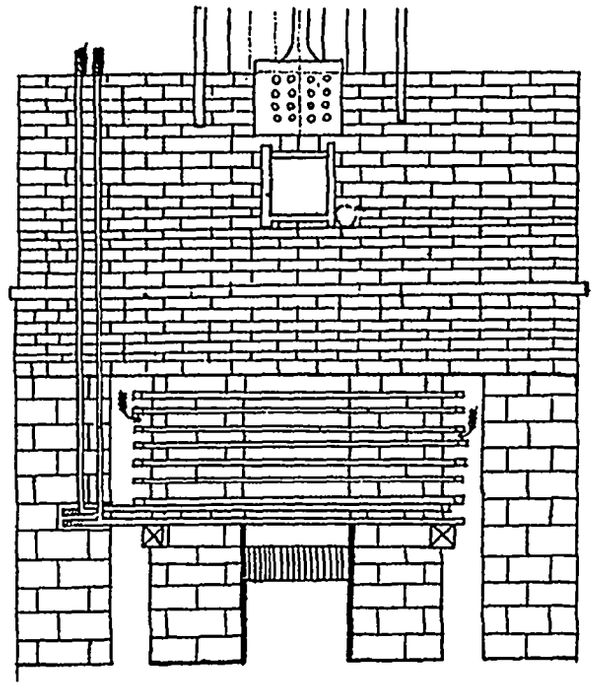
—A new industry which will undoubtedly assume large proportions is the building of steel freight cars. It has been found that the dead weight of a freight train can be greatly decreased by substituting steel for wood in car construction. The steel is much stronger for the weight and hence much larger loads can be carried. What are known as " 100,000-lb. cars " are rapidly coming into use, and a company with a capital of $10,000,000 is said to be organizing in Chicago to build them. Their introduction on our Canadian railways is only a matter of a short time and great changes in the present railway car shops are to be expected. The increased demand for steel in the Canadian market will be welcome to our growing iron industries.

HOT WATER HEATING.*

BY P. TROWERN.

In my first address to you on this interesting subject I directed your attention to the plans, inventions and information given to us by our forefathers within the last 1,000 years for their own comfort, education and civilization. I wish to direct your attention to the plan and furnace of Mr. Perkins (1830). He claims to be the inventor of the apparatus that is used in heating some of the largest buildings in London, England, and France; you will observe in this sketch that the boiler in the brick furnace is made with 1-inch heavy iron pipes, bent square with round corners, two coils, one inside and the other outside; the inside one is about 3 feet square, and the outside 3 feet 6 inches, which takes from 120 to 130 feet; they are bent like a spiral spring so as to stand one row above the other for eight rows, and are kept there with cast stays and distance pieces. The pipes are all screwed together with right and left couplings, tested with a water pump before being put into place, the fire-bars are 26 inches long and 30 inches wide, the walls inside the coils are built with fire-brick, the door is bolted and built in the front wall. The square hole on the top with a sliding cover or door is to put in the coal and to damp the fire, the hole in the cover is the down draught, the lower pipes projecting through the brick is for the return water to come back into the coils. The pipes projecting through the top are for the hot water to pass out of the coils up to the water expansion cylinder, the two pipes, hot and return, are tapped in the bottom, the cylinder, which is 3 feet high by 12 inches diameter, with a brass tap and cover on top; into this cup the water was at first poured; however, I found this to be a bad plan and I used it only to let out the air. I put taps on to the return pipes with connections, and had a pump made so as to fill them in the furnace room, when any water was wanted; the same water I put in in the fall came out in the spring. The quantity of pipe connected with each coil or boiler was about 700 feet or the number of feet for each furnace with coils of this size was about 1,650 feet, and as 29½ feet of this pipe will hold one gallon of water we find the two coils or boilers in the one furnace contained about 56 gallons to be heated with one fire with about 175 lbs. of hard coal for 24 hours or about 18½ tons per season (212 days), and this furnace or pipes heat about 94,048 cubic feet of air to about 75°. Fifty-five people are here kept warm and comfortable, their cooking being done in the kitchen. A very cold night will require some coal in the early morning; the last fire was put in about 8.30 at night, and about every week the water should be gauged in the cylinders which are on pedestals in the corridors with a rod or wire to find if any has evaporated through the joints or pipes.

You wish to ask some questions. How long will those boilers last? Out of the sixty coils I have made, some were



burned in five years, some in ten years; the only four we have left now working are those in the cottages A and B I made 27 years ago. The two pipes, flow and return, are laid around in recesses against the outer walls and partitions above the base-boards; they have been in the main building for nearly 50 years, and in the cottages for 32 years.

The next question is how does the water move, or by what force does it circulate? I have said before there is no force or power in this world without heat, the pipes are all full and the cylinder half full; we will now start the fire and the pipes will soon feel warm, and with every degree of heat the water becomes lighter by expanding, and the cylinder becomes fuller; the air leaves the water and pushes its way to the cylinder on top of the water and becomes of great force if not let out by the tap on top. The water in the return pipe is not warm, and is therefore heavier than the water in the flow pipes and cylinder, before the fire was put in, one side balanced the other like an even-balanced pair of scales, but now the flow side becomes lighter, by the water being warm, and the return water being heavier, pushes itself into the boiler to get warm. Each coil has an expansion cylinder, and those two cylinders are in one ward about 34 feet above the furnace, and in each cylinder and pipes are about 28 gallons or 280 lbs. of water; it will not gain in weight, but it does in measure; 22 gallons of water at 40° will gain one gallon at 212°, therefore, those 28 gallons have gained about 1¼. This is the reason why we do not fill up the cylinder at first with the pump; when the fire was started and the water got warm it began to expand and move out of the coil by the weight of the return water pushing into the coil; this is the cause of the movement and force to keep it in circulation. You may ask me why I use a 1-inch pipe rather than larger. It is because I found a 1-inch pipe made a quicker circulation and was much more convenient to handle for the rooms in a dwelling house.

In our last greenhouse which we built I put in 2-inch pipes, and found them better in every way than the 4-inch pipes I had used in the other houses: their cylinders for expansion have a loose cover so that the air can go in, and the vapor which is needed for the plants come out; but in a dwelling the vapor is not wanted.

*From a paper read before the Canadian Association of Stationary Engineers.

The Winnipeg Electric Street Railway Co., Winnipeg, Man., has ordered 18 additional railway motors, with controllers, from the Canadian General Electric Co., of that company's standard " C.G.E. 1,000" type.