TIN PLATE MAKING.

BY FREDERICK HOWELL.

Quite a number of persons have the idea that tin plate cannot be made in this country, but must be made in England, because the tin is found there. Wishing to correct this impression, I have taken "tin plate making" for my subject.

Tin is found chiefly in the counties of Cornwall and Devon, in England; in the regions of Bohemia and Saxony, in Germany; in the Island of Banca and the Peninsula of Malacca, in the East Indies; it is also found near Durango, in Mexico, and in the American basin in Colorado and other parts of these United States. It exists in nature, but in a few different States. Pure native tin is found in leaves or plates. There is a white sparry ore of tin in octohedral crystals. Tin ore is in some instances of a yellowish-white color, often colored and semi-transparent, like Topages. There is a brown reddish tin ore in cubic crystals, more or less regular. This metal exists also in a sort of tin stone, or rather sand, which is grey, blue, brown or black, and contains a mixture of oxyde of tin. Sulphurous tin ore is another variety, which bears a resemblance to zinc. The ores are pounded, washed, roasted in reverberating furnaces, smelted at last in other furnaces, and poured into moulds which give it the form of blocks—hence the name of block tin. Pure tin is a glistening, white substance, soft, light, scarcely sonorous, susceptible of being scratched by the nail, very fusible and very combustible. It is exceedingly pliant, and when bent produces a crackling noise called "the cry of tin." It has a sensible smell, which becomes somewhat stronger when the metal is rubbed. Its taste is peculiar and disagreeable. It holds the sec-

ond place among the metals when they are arranged in the order of their ductility. It is so tenacious that a thread or wire of tin one-tenth of an inch in diameter will, without breaking, sustain a weight of fifty pounds. Tin very quickly melts; it is, of all metals, the most fusible; greater intensity of heat at length volatilizes it. When the metal is heated in contact with air, a pellicle of a dirty grey oxyde is formed on its surface. Tin is used for various purposes. Mosaic gold is a beautiful amalgam of tin with sulphur. The amalgams of tin with mercury is used to silver looking-glasses. Tin is given in powders as a medicine. The oxydes of tin, in different combinations, are of great use in the dyeing of some beautiful colors. Bronze, or bell-metal, is an alloy of tin with copper. The uses of tin in covering plates of iron, for the manufacture of of domestic utensils, and other purposes, has become one of the leading industries of Wales, and to give you a description of its manufacture is the object of this paper.

The pre-requisites in the manufacture of tin plate are—iron which composes the body of the plate, coal for the purpose of manufacturing, and power to drive the machinery. Wales, having these in great abundance, became the seat of tin plate manufacturing. A tin plate mill differs very little from an ordinary rolling mill. The pig iron is puddled and rolled through the different rolls until a good bar of the required size is made, which, for 1 C plate, is six inches wide by five-eighths of an inch thick. This iron then goes to the tin-mill proper, containing one or more sets of plate rolls, with a double reverberating furnace to each set, plate and steel shears and cold rolls. The bar of iron is then cut into lengths suitable to the required plates, and the pieces are then placed in one of the furnaces; when sufficiently heated, it is rolled in the opposite direction from the grain of the iron until it is about six feet long, when it is doubled, then reheated, rolled, and doubled again and again, until there are eight thicknesses and the piece is long enough to shear into two lengths. The plates of each day, or turn, thus rolled are then taken to the shearer, who shears them to the proper size; they are then taken by boys, who separate the sheets and place them in heaps of seventy-five each, three heaps making a box; from here they are taken to the pickling-room, where they are immersed in a bath of diluted sulphuric acid, and stirred until the oxide is removed from the plates. They are then taken to the annealing-room, where they are placed in air-tight

vessels, and subjected to a white heat in the annealing furnace for nine hours. The plates, after being cooled and taken out, are as soft and limber as a sheet of thin lead. They are then taken to the cold rolls, which are highly polished, and run through twice. This stretches each plate seven-eighths of an inch, and gives them that stiffness called the "set" of the plate. The plates are again taken to the pickling-room, where they are again immersed in a weak solution of sulphuric acid, so as to remove the blue shade given the plates while being annealed, making them appear as bright as sheets of silver. They are now ready for tinning, and are laid in water to prevent their oxidizing before being used in the *tin-house*. The tin-house is fitted with one or more sets of ranges of iron pots, placed over small furnaces to keep the metal continually in a liquid state. This melted tin is covered with tallow and palm-oil to prevent oxidizing. Before this range stands a tinman with two pots, one of grease and one of tin, a washman with two pots of tin, a grease-boy and a list-boy; and to the left of the list-boy stands a case of bins, containing bran or middlings, at which stands three girls, and beyond these a polisher. There is also a sorter's table and bench for boxing the plates. The tinman, having taken a quantity of plates from the water-trough in the pickling-room, places them separately in his grease-pot, this being the medium by which the tin is made to adhere to the iron. He then removes them to his tin-pot, where they remain for a short time and become covered with tin. They are then taken by the wash-man and placed in his soak-pot, and are afterwards, by him, taken out singly, brushed with a hemp brush, then dipped in the wash-pot, and placed in the rack in the grease-pot. The time they remain in the grease-pot is governed by the divisions in the rack, and this regulates the quantity of tin left on each plate. They are removed from the grease-pot by the grease-boy, who places them in a rack by the list-boy, who in turn takes them, and, placing them in the list-pot, melts off the heavy edge, or list, about one-fourth inch on the lower edge of the plate. The plate, being now covered with grease, goes to the bran-girls to be cleaned; each girl dips it in the bran twice, which takes off all the grease. The polishing-girl now gives it a rub on each side with a chamois leather glove, and the plate is complete. It then goes to the sorter's bench, where the plates are examined and sorted, and put up in packages of seventy-five, or one-third of a box,

made to weigh correctly by exchanging some of the plates—putting in others heavier or lighter as may be needed. They are then boxed and branded, and, if got up for American orders, those made from good scrap are often branded charcoal. Thus you see that to make tin plate requires iron, coal, with power to drive machinery, tallow and bran. These are all produced here in much greater abundance than in Wales. There is but one reason then why this country should be dependent on England for its supply of tin plate, and that is want of a protective tariff.

THE PRESIDENT.—The remaining programme for the evening will be the discussion informally of the following subjects: Signals in Mines, Lighting of Mines, Fees and Salaries, Mining Machinery, Old and New Methods of Working Coal, Mining, Engineering and Surveying, New Legislation, New Litigation, Surveying Instruments, Oils, Lamps, How to Keep Survey Points, Drill Holes, What is Minable Coal, Horsebacks, Reports of Committees, The Subscription Price of the JOURNAL.

Signals in mines is a subject about which there is great diversity of practice. Mr. Head, who has, I believe, a very good system in use at the mines in his charge, is able to say something valuable on the subject.

MR. R. M. HAZELTINE.—What do you include in that item, "Signals in Mines?" Does it refer to signals used in the transmission of minerals to the surface; or, to horizontal signals from one end of the mine to the other?

THE PRESIDENT.—It includes all kinds of signals that may be thought of, and are used in and about mines.

MR. HEAD.—Mr. President, I have studied a little in relation to signals in mines, and especially in shafts, because there has been so many accidents by the letting of cages down into shafts. I sunk the Garfield Shaft, and endeavored to arrange signals in such a way as to avoid accident of that kind. If an accident should occur it would be due to the neglect of the engineer. I adopted what we call a signal for the engineer, which is worked by a small rope attached to the gear wheel of the drum, and then placed on a small board, with a wheel in the top of it and a weight running down the shaft between two guides. Every time the engineer lets the cage down this weight makes one revolution, and on the way up it strikes a little spring which rings a bell. The

cage is then to the lower landing, which is 22 feet from the bottom of the shaft. When the bell rings the engineer draws down his wire twice; that is a signal to the man in the bottom that the cage is coming down. No man, except a man employed for that purpose, is allowed to touch the signal to the engineer, and the bank boss has strict orders from me to discharge any one who violates this rule. When men are coming up three knocks are made to the engineer to hoist the cage. The engineer answers back by one knock; the men then get in the cage, and before the engineer starts his engine he signals back that he is going to hoist the cage. When he is raising men, and about four or five feet below the lower landing, he gets another signal. I also made a gangway at the bottom of the shaft so the men can pass around on the other side without passing under the shaft. I would advise the general adoption of these signals. Some people may think so many signals around a coal bank would be troublesome and consume too much time, but it adds time to the work. After half-past four o'clock miners come to the bottom and are anxious to get up; they occasionally get to pushing each other, and when the cage comes down there is a rush for the cage. By the use of my signals and a strict observance of the rules all this can be avoided. The man at the bottom, who controls the signals, gives each man that gets in the cage a check until eight checks are given, which is the number that is allowed to ride up at a time. Each man hands back his check. If any man gets on without a check he is ordered off; if he refuses in the course of fifteen minutes he is reported and ordered to be discharged.

A place should be provided at the bottom of the shaft so that miners can be seated. As a general thing there is plenty of room and it does not consume much time to place a plank there for them to sit upon.

I have adopted another rule. Sometimes three or four miners want to come up about two or three o'clock, when there is coal in the bottom of the shaft. I do not allow them to go up until there are six, no matter how bad I want the coal. I give them this privilege because I do not want them to sit there in their wet clothes until half-past four o'clock. If every man would live up to these rules I think there would be less trouble and expense in the bottom of shafts. There has been a great deal of trouble in our valley, and also in the Tuscarawas Valley, which could be avoided by the

proper use of signals and rules for hoisting men through shafts. My experience is this: If you want to successfully control a body of men in a mine you must give them some privileges. It always works better, and they have more confidence in you than if you take all the privilges yourself and grant them none.

MR. PRICE.—Mr. President, I think these signals are very good. I feel tired; if I felt better I would like to talk about those and other signals in mines. I will merely refer to one signal along entries. We visited several mines to-day and I find things quite different from the way I have it arranged. In meeting a driver, if he can see my light I can stop him. If a miner wants to stop a driver any place all he has to do is to wave his light.

MR. MULLIN.—Mr. President, I had at one time an experience of a ludicrous character where no kind of signal could have done any good. It simply illustrates that self-preservation is the first law of nature. When we were sinking our air shaft at Floodwood, and before we got down to the bottom, we were hoisted up and down in buckets. We had a mule that was fractious, and one day as I got about half way up the mule ran away and I was brought up against the top of the gin-pole; the most natural thing for me to do was to catch hold with both hands at the top of the pole. The Irishman, who was down below, seeing my condition, halloed up, "For God's sake, Mishter Mullin, hould on; if you drop down you'll kill me." (Laughter).

THE PRESIDENT.—The next subject for discussion will be Fees and Salaries.

MR. HEAD.—Mr. President, What does that subject mean, in the first place?

MR. PAUL.—To adopt some uniform scale for mining engineers' work. For instance, what would be a proper charge for day work or night work, or any especial class of work.

MR. R. M. HAZELTINE.—I don't think it comes within the province of this society to establish a scale of prices for surveyors and mining engineers. The services of one engineer may be worth $25 per day, while that of another may not be worth one dollar. If an engineer is not competent to do his work correctly he is an expense to his employer, even if he does his work for nothing. In this region the scale of prices for surveying has been better and

more uniform than in other portions of the State. In the bituminous regions of Pennsylvania surveyors get more money for their work than we do here.

A mining engineer is called upon to perform a thousand and one duties. He acts as arbitrator between lessee and lessor; he adjusts royalties; he estimates coal in various positions and quantities. He grows in value and experience. A young engineer, fresh from a mining school, cannot command the same fees and salaries as one who, in addition has had ten or twelve years of practical experience in and around mines. I do a great deal of work that I call expert work; I learned it by years of experience in the mines; it is not taught in any school on the face of the earth, but it is taught in the school of experience; for that I charge whatever I think my services are worth, and whatever the exigencies of the occasion demand.

MR. HEAD.—Mr. President, a man's ability determines his salary and this society has no business to inquire what any engineer gets. This is not a trades union. The discussion of this subject cannot advance the interests of the Institute, and can only do mischief.

On motion, this subject was declared to be out of order, and its further discussion by the Institute was prohibited as foreign to the objects of the Association.

THE PRESIDENT.—The next subject is Mining Machinery, and this will refer to everything connected with the working of coal. I read a brief paper before the Institute on coal-cutting machinery, and expected Mr. Berry to discuss it at some length, as he has had experience for several years with the Lechner Coal-Cutting Machine in the Hocking Valley. Mr. Berry was not present when the paper was read, but he may have something to say on this subjet now.

MR. BERRY.—I do not believe that I have anything to say now. I feel rather tired after our excursion to the mines to-day.

THE PRESIDENT.—The next subject is, "Old and New Methods of Working Coal."

Mr. Price addressed the Institute, showing by a map two systems of working out a forty-acre tract of coal; one by the double entry system and one by driving only two entries. He said, it shows the number of yards of entry that it requires to excavate

40 acres of coal, minus the pillars. On the plan of this working there are 3,560 yards of entry. This is the double entry system, which is conceded to be the best system in use either in this or the old country. With the other, which is my system, I can excavate the same amount of coal with 890 yards of entry (pointing to the two plans).

Owing to the lateness of the hour and the smallness of the maps, the President suggested that the further discussion of this subject be postponed until the next meeting of the Institute.

The election of members being in order, Mr. Zachariah Titlow, of Leetonia, was elected a member of the Institute.

Under suspension of the rules the following gentlemen were elected honorary members: Col. Charles Whittlesey, of Cleveland; C. H. Andrews and John Stambaugh, Youngstown.

The Committee on Constitution reported in favor of two annual meetings, one to be held at Columbus in January, and one to be held in the coal fields of the State upon the call of the President.

The report was adopted and the Constitution amended accordingly.

The subject of the subscription price of the JOURNAL was taken up. On motion, the price was reduced to sixty cents per year, or fifteen cents per single copy, the object being to place the JOURNAL in the hands of the intelligent working miners of the country, who have, since the organization of the Institute, taken a deep interest in its proceedings.

The discussion of the remaining subjects of the programme were dispensed with, owing to the length of the session; they will be renewed at the January meeting in Columbus.

The relations of the *Trade Review*, of Cleveland, the former official organ of the Institute, was mentioned incidentally. The President stated that the Institute, as a body, had had some misunderstanding with the former proprietors of the *Trade Review* in regard to the publication of the paper of the Institute, but so far as the present proprietors of the *Review* were concerned, the relations of both interests were harmonious and friendly. He desired to make this statement in justice to the present proprietor of the *Trade Review*.

The Institute then adjourned to meet in Columbus in January next, as provided in the Constitution.