THE FINK SMELTER.

By W. C. EBAUGH.

Much interest has been aroused in metallurgical circles by the test made with the Fink smelter at the Boston Consolidated Company's plant at Garfield, Utah. The successful operation of the experimental furnace during its trial run—when concentrates containing about twenty per cent. of copper were reduced to blister copper in a short space of time—has led the more enthusiastic and hopeful smeltermen to assert that a revolution in the treatment of fines has been effected, and that many properties that cannot be operated at a profit under present conditions will be made of value through the introduction of the new process of smelting. Whether these claims are too extravagant can be determined only after operations have been carried on under commercial conditions upon a larger scale.

As shown by the accompanying illustrations the Fink plant consists essentially of two large rotating compartments, lined with refractories, between which is a flue for the passage of the gases from one compartment to another, as well as the openings for the introduction of the fuel. These smelting compartments or cylinders are made in the

shape of truncated cones placed base to base, connected at one end with the central flue and at the other with a chimney. In the plant at Garfield, which is estimated to have a daily capacity of one hundred tons, these cylinders are nine feet in length, nine feet in maximum diameter, and taper to seven feet at the ends. The lining reduces the maximum internal

Fig. 1.—The Fink 100-ton smelter at Garfield, Utah.
Photograph by C. W. Higgins. Courtesy of Salt Lake Mining Review.

diameter to about seven feet. Each end of the cylinder has an opening three feet in diameter. These cylinders are rotated by friction on trunnion wheels, but in future installations it is planned to have direct gear drives in order to avoid slipping.

The fuel is introduced through cast iron, muffle-shaped pipes that can be seen below the central flue. Either crude oil or powdered coal can be employed, and as a matter of fact the Garfield plant was built to be run with oil, but failure to obtain a supply at the time of the test resulted in a modification of the feeding mechanism so that powdered coal could be used, and this fuel was found to be satisfactory. When it is remembered that coal and coke for smelting purposes are necessarily expensive, because of the high grades required, it is evident that a furnace that can use slack coal (either anthracitic or bituminous), crude oil or even sawdust as a fuel has a distinct advantage over the ordinary smelter.

Fig. 2.—Front view of the new Fink smelter.
Photograph by C. W. Higgins. Courtesy of Salt Lake Mining Review.

Through the top of the central flue, tuyères, that reach into the charge in the cylinder, can be introduced. These tuyères are provided with magnesia tips and are water-jacketed. Screw conveyors carry the charge from the bins through the walls of the stack compartments at the ends

cylinder is then rotated, and the gases from the smelting operation going on in the other cylinder are led consecutively through the middle flue, the cylinder with the fresh ore, a dust chamber, and thence to the stack. No fuel is required directly for the roasting, the sulphur from

the ore and the heated gases from the other cylinder sufficing. At the proper time the charge in the other cylinder is removed, and the now roasted ore, in the cylinder with which the explanation was started, is ready to be reduced to matte. Burning fuel is blown into the cylinder, the particles of ore in the finely divided condition are quickly reduced to matte, and ordinary slag is formed. Care must be taken to regulate the composition of the charge properly and to stop the operation at the right time. If it should happen that the blow had continued too long some fresh ore or flux could be introduced and restore the charge to its desired condition. This factor of ease in regulating the various operations in the cylinder is considered as an

Fig. 3.—Fink smelter, showing revolving cylinders and chamber.
Photograph by C. W. Higgins. Courtesy of Salt Lake Mining Review.

of the cylinders and directly into the smelting cylinders. Around the middle line of each cylinder are three tap holes for the removal of slag, matte or metal.

In the Fink smelter the inventor has applied the principle of the revolving roaster or black ash furnace, but with the important difference that in this instance there is no end fire box, the fuel being burnt in the cylinder itself. There is the additional advantage that when a bessemerizing action is wanted it is carried out in the same cylinder through the introduction of tuyères, as indicated in the preceding paragraph. It is possible, therefore, to first roast, then smelt to a matte, and finally bessemerize the matte without ever removing the charge from one cylinder. It is this economy of labor, as well as economy of fuel, that makes the new process attractive.

In operating the furnace both cylinders are in use at the same time. The ores or concentrates are fed into one cylinder which still contains the slag from a preceding bessemerizing blow. The

other advantage of the process. Slag is tapped through one of the three tap holes along the middle line of the cylinder, and the remaining matte is bessemerized by having the tuyères introduced through the top of the central flue, through the hole at the end of the cylinder and directly

Fig. 4.—Another view, showing the main working parts of the Fink smelter.
Photograph by C. W. Higgins. Courtesy of Salt Lake Mining Review.

into the molten matte. A silica flux is added to the matte to flux off the iron, thus avoiding the excessive corrosion of the lining of the cylinder. Either a high grade of matte (white metal) or bullion can be made at will. At the end of the blow the finished product is tapped off into molds, and the superincumbent slag, which will contain more or less copper, is retained to be worked up with a fresh charge of ore.

The tests carried out with the Fink process have been declared successful. Samuel Newhouse, whose word concerning metallurgical and mining matters carries weight, is quoted in the press as follows: "You are now at liberty to say for me that the Fink process of smelting ores is a demonstrated commercial success. You can make the statement just as strong as you like. * * * There is no question of its amounting to a revolution in the art of smelting; it is a triumph in the science of metallurgy that must command world-wide attention. The process will be the means of making mining profitable in hundreds of places and under innumerable conditions where and under which profit-making is now impossible." (Signed interview by Samuel Newhouse in the Salt Lake City *Herald* of January 18th, 1909.)

The advantages claimed for the process are: (1) that fines and concentrates can be smelted without preliminary treatment; (2) economy of fuel, for roasting is carried on by the aid of waste heat from the smelting operation, and either slack coal or crude oil can be used as fuel; (3) prevention of the loss of fines, for the green ore is not subjected to a blast while it is dry, but is run into the residual converter slag from a preceding operation; (4) complete conversion of ore into metal without removal from one compartment; (5) convenience for use in either intermittent or continuous smelting, thus adapting it to the small producer and to places where the ore supply is irregular; (6) repeated use of the furnace without relining; (7) low cost of installation.

Opposed to these advantages one must consider the following objections to the process: (1) its inability to compete with present blast furnace and reverberatory practice in handling large tonnages of ore obtainable in a regular supply; (2) that the desirability of trying to carry out three different such operations as roasting, smelting and bessemerizing in one piece of apparatus is open to question; (3) the possibility of obtaining clean slags without using some form of settler; (4) that the introduction of raw ore into a cylinder containing a mass of bessemer slag would result in a loss of roasting efficiency.

Until long runs are made under conditions that approximate those that are encountered in practice, judgment as to the cost of operation cannot be made with accuracy. It is said that such tests are to be carried out as soon as possible at Garfield and at the Cactus plant of the Newhouse Mines and Smelters Company.

UNIVERSITY OF UTAH,
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QUOTATIONS.

(From Schimmel's Semi-Annual Report—Fall 1908.)

PEPPERMINT OIL, AMERICAN.

We have again received a detailed report from our New York branch, whose expert has visited this year, as usual,

all the peppermint districts. We abstract the following from this interesting information:

(1) WAYNE COUNTY, NEW YORK.

The area cultivated with peppermint is this year confined chiefly to the districts of Arcadia, Lyons, Sodus, Marion and Palmyra, while Williamson, Junius and Galen, as shown below have only very small plantations. The cultivation continues to decline from year to year, as all hopes of a permanent revival of the peppermint oil prices have after the experience of the last few years, been abandoned almost everywhere, and it is found more remunerative to grow wheat, buckwheat, sugar-beets, beans, or peas on the fields, and lately also willows for the manufacture of baskets. The bulk of the peppermint harvest this year is two years old, and experience shows that the quality of the oil in such case cannot exactly be called first-class. No less a quantity than 20,000 lbs. peppermint oil from last harvest is still unsold in the hands of the farmers, who are reported to be determined to hold back also the bulk of the new product, if better prices than in 1907-8 cannot be obtained this season.

The area under cultivation is made up as follows:

	This year's (1908)	Last year's (1907).
Williamson.....	2 acres	4 acres
Marion.....	10 "	40 "
Palmyra.....	13 ½ "	18 "
Sodus.....	13 "	20 ½ "
Arcadia.....	43 "	113 "
Junius.....	3 "	11 "
Galen.....	6 "	10 "
Lyons.....	31 "	40 "
	121 ½ "	256 ½ "

The falling off in the cultivation is clearly shown by these figures.¹

The result of the distillation of the whole area may be probably taken as follows:

121 ½ acres at 30 lbs. average.....	3645 lbs.
257 ½ acres at 12 lbs. average.....	3090 lbs.
	6735 lbs.

Add to this stocks amounting to about.....23000 lbs.
Makes a total available quantity of about.....30000 lbs.

It follows that in spite of the great shortage in the cultivation, there will be no scarcity of this oil, for the above quantity may be described as absolutely normal.

(2). MICHIGAN AND INDIANA.

In these districts also the distillation has to fall back chiefly on peppermint of last year's growth, as, owing to abundant rains in the spring, new plantations could be laid out only in a very few places. On the whole the fields are very weedy, so that the distillation material also leaves much to be desired. The stocks of 1907 oil are here also very considerable; our informant speaks of about 46,000 lbs., while others even mention 75,000 lbs. as having been held back by the farmers. The harvest is rather late this year, so that a second cut was out of the question.

The production of this year may bring the stocks still on hand to a quantity which approximately equals that available last year—as is the case in the state of New York—but the opinions of individual observers differ considerably on this point. Owing to the low prices the farmers in Mich-

¹ Comp. Report, Oct., 1907, 69.