# MANUFACTURE OF ZINC PIGMENTS

## Description of the Process Used at Coffeyville, Kansas, for Making Zinc Oxide and Leaded Zinc

*Written for "Mines and Minerals," by Evans W. Buskett*

The process of making zinc oxide and leaded zinc in use at Coffeyville, Kan., is a modification of the old Wetherill process, which has been in use for a great many years. The first application of this process was by Richard and Samuel Jones in 1850. The process was modified by Samuel Wetherill in 1851, and has been in use by the New Jersey Zinc Co. ever since.

In 1900 Mr. William F. Gordon entered the field and erected a small plant at West Plains, Mo., to treat the carbonate ores of Howell County. The product of this company was of good quality but their finances were limited and a failure was the result. Mr. Gordon immediately organized another company in St. Louis and erected a plant at Joplin, Mo. This proved a success and the use of soft coal and western ore was attempted. This was also successful and led to the designing and erection of the Coffeyville plant.

The erection of the Coffeyville plant began in the fall of 1905, but owing to the heavy rains was not ready for operation until March, 1906. The erection of the second block of furnaces and bag room was begun in November, 1906, and completed in August, 1907.

As it now stands this is the most complete oxide plant in the West. It has a daily capacity of 60 tons of ore and is adapted to the manufacture of either zinc oxide or leaded zinc. Being in two separate units it can all be employed in the making of one kind of pigment, or one unit may be used to make zinc oxide while the other is making leaded zinc.

While this process is adapted to any ore of zinc and lead, ores free from cadmium, antimony, bismuth, and arsenic are preferred, as these metals are detrimental to the color of the pigment.

The most desirable ore is one in which the zinc and lead contents are in the proportion of 2:1; for instance, an ore containing 24 per cent. zinc and 12 per cent. lead = 36 per cent. total metal. Ores carrying less than 30 per cent. total metal are undesirable as the fixed charges are too high to permit of their economical treatment. If ores containing metals in the proper proportions cannot be bought they may be made by bedding ores of varying metallic contents and the desired proportions secured in this manner.

The ore is all bought on a basis of 30 per cent. metallic contents with a premium for every unit above and a dockage for every unit below that figure. The settlement is made on the combined assay of zinc and lead. If the lead assays check and the zinc assays are far enough apart for umpire, both lead and zinc are umpired, and the settlement made on the sum of the umpire assays.

The ore is unloaded from the car into a 10″×15″ Blake crusher which discharges into a Gates elevator by which the ore is carried to the top of the building. Here it is discharged into a revolving screen having ⅝-inch openings, the oversize going to a set of rolls on the second floor. These rolls are 18 in. × 36 in. and are equipped with locomotive tire-steel shells. The ⅝-inch material is discharged into a second trommel the openings in which are ¼ inch. The oversize from this screen goes to another set of 18″ × 36″ rolls, on the first floor, and after passing these rolls is elevated and discharged into the set of rolls on the second floor, which discharge into the ¼-inch trommel.

The ore after passing the ¼-inch trommel is elevated to a mixing drum which discharges into a Vezin sampler which cuts out one-fifth. This one-fifth is discharged into a Bridgeman automatic sampler which cuts out a sample weighing about 500 pounds. The discharge from the samplers is elevated to the bins. The crushing machinery is driven by a 50-horsepower motor.

There are 18 bins arranged so that the ore may be drawn from beneath into the cars.

The roasting is done in two, five-hearth McDougall furnaces which are driven by a 30-horsepower motor. They are fired by gas, ordinary 1″ × 2″ mixers being used for burners. These furnaces have a capacity of from 20 to 25 tons each in 24 hours.

The ore is taken from the bins in cars which have a capacity of 2 tons. They are provided with bottom gates through which the ore is discharged into the elevator boot at the McDougall furnaces. The elevator carries it to the top of the furnaces where it is discharged into two large hoppers, one on each furnace. From these hoppers it is fed automatically to the roasting hearths.

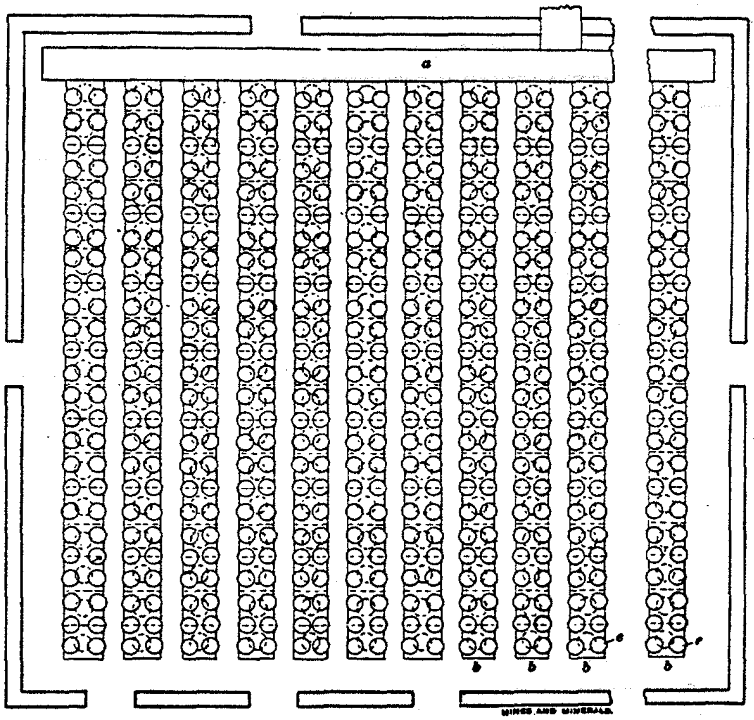


Fig. 1. Plan of Bag House

The roasted ore, which now carries 3 per cent. sulphur, is discharged into cars with bottom gates which are pulled up an incline over the cooling bins and discharged. After cooling the ore is shoveled into cars which are weighed, elevated to the furnace track and distributed to the oxidizing furnaces.

There are two blocks of oxidizing furnaces each containing 18 furnaces. The furnaces are 6 ft. × 12 ft. the bottom being made of grates 1½ in. × 8 in. × 72 in. These grates are perforated with conical holes 1½ inches apart, the holes being ⅛ inch at the top and ⅜ inch at the bottom. The blast enters the charge through these holes.

In charging, the grates are first covered with a layer of coal. When this is burning freely the charge of ore and coal is thrown in and distributed evenly over the grate. While burning the charge is raked as required.

The blast is furnished by two fans driven by a 30-horsepower motor. The blast is carried to the furnaces by a large underground conduit and is discharged under the grates through holes in the bridge wall. The air for each furnace is controlled independently by a draft grate.

The fumes are drawn from the furnaces by a large exhaust fan which is located at the bag room. This fan is driven by a 40-housepower motor and has water-cooled bearings. The fume first enters the combustion chamber where the carbon is all burned out, and the dirt allowed to settle. It then passes through 600 feet of cooling pipe by which means the temperature is lowered so that it will not burn the bags in the bag house. It then enters another large chamber where there is an additional settling. From this chamber it enters the fan and is driven into the bag room.

The bag room is 90 ft. × 140 ft. The fume first enters a lateral pipe *a* called the breech from which it is distributed to 18 pipes *b*, each of which has 17 hoppers below shown by dotted circles in the plan Fig. 1, and marked *c* in Fig. 2. On these hoppers are tied short bags *d* reaching to the floor. In the top of the pipes are two rows of thimbles, 25 in a row, on which are tied the 30-foot bags *e*, which do the sifting. Both long and short bags are 24 inches in diameter. This makes a total of 900 long, and 306 short bags. The oxide accumulating in the long bags is shaken down into the short bags which are removed every 24 hours. These bags are dumped into a conveyer which carries the oxide to the packing room. There are two packers driven by a 20-horsepower motor. The oxide is packed 400 pounds in a barrel and loaded to th.: market.

Electric power is used in this plant. The boiler room is 50 feet square and contains two 180-horsepower boilers fired by gas. Zimmerman burners are used, there are six burners to each boiler.

The engine room is also 50 feet square there being room for two engines and generators. The engine is a 250-horsepower Allis-Corliss which drives a 150-kilowatt Bullock generator, from which the power is distributed to the different departments. The switchboard is provided with Weston direct-reading voltmeter, ammeter, and wattmeters, and circuit breakers of the most improved pattern.

The coal used is nearly all Arkansas semianthracite and all goes through the coal crusher. It is unloaded from the cars into a hopper at the bottom of which is a pair of toothed rolls. After passing through these it is discharged into a pair of rolls which reduce it to about ½ inch. It is then discharged into an elevator which carries it to a large hopper at the top of the building. From this it is drawn off into cars, which run on the same distributing track as the ore cars, and is carried to the furnaces or storage yard. The coal crusher is driven by a 30-horsepower motor.

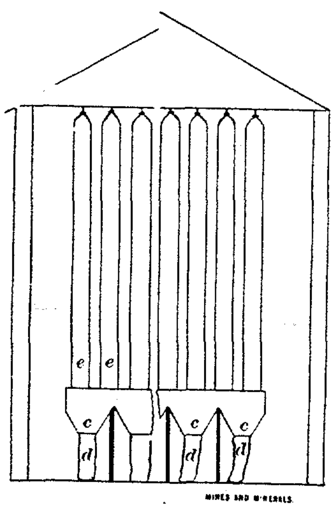

Fig. 2

This smelter has the best laboratory in the State of Kansas so a word about it will not be out of place.

The building is 30 ft. × 40 ft., containing a chemical laboratory 20 ft. × 30 ft., an assay room 20 ft. × 20 ft., a weighing room 9 ft. × 13 ft., which opens into both the laboratory and assay room, and a toilet room opening off the weighing room.

The laboratory is equipped with a hood 8 ft. × 4 ft. which is large enough for four chemists to work at once. Around the sides of the room are work tables equipped with funnel racks, burette stands, and other necessary apparatus. A sink with hot and cold water and ample drain boards is conveniently placed between the ends of the two main work tables.

The assay room is equipped with a gas-fired furnace. This furnace has a large melting chamber below, heated by a 1″×2″ mixer, and two 9″×15″ muffles above heated by two 1″×2″ mixers. At the side of the furnace is a boiler-iron table 3 ft. × 6 ft. supported by brick pillars, and the table and furnace are both covered by a sheet-iron hood which serves to carry off the gases.

The weighing room has a balance table made of three-ply cypress supported on three concrete pillars which do not touch the floor and are therefore free from vibrations of the building. A Thompson analytical balance occupies this table and it is the intention of the company to add other balances when needed.

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Consul Pendleton King, in response to a letter of inquiry from California, writes from Aix-la-Chapelle as follows, describing the restrictions under which ore smelting is carried on in Germany:

The damage caused by the pollution of the atmosphere through metallic fumes to the health of people and live stock and the injury to the architecture, agriculture, and foresty in the neighborhood of the big smelters of Germany caused in the last 25 years the working out of a general scheme or plan of improvement. Through this the Federal Government, with the full understanding of the many difficulties to be overcome and the many problems and complications originating from clashing local interests to be solved, appointed official inspectors to supervise each district, giving them full judicial, police, and executive power to take testimony in each case of complaint or petition for granting of a charter and adding of new local statutes required by necessity and to punish any noncompliance with the provisions of the Federal or local regulations.

These fundamental regulations, the product of careful study, and the wish of the Government to protect the people against any nuisances without impairing the success of the flourishing metallurgical industries of the country, subject the carrying on of zinc, lead, and copper smelting to stringent statutes, copies of which may be obtained from the Bureau of Manufactures at Washington.

# CORRESPONDENCE

*This Department is intended for the use of those who wish to express their views, or ask or answer questions on any subject relating to mining. Correspondents need not hesitate to write for supposed want of ability. If the ideas are expressed, we will cheerfully make any correction in composition that may be required. Communications should not be too lengthy, and personal reflections should be carefully avoided.*

*All communications should be accompanied with the proper name and address of the writer—not necessarily for publication, but as a guarantee of good faith.*

*The editor is not responsible for views expressed by correspondents in this Department.*

*☞ Correspondence should be in as simple language, and as free from technical terms and formulas as possible, consistent with clear solution.*

*Questions on subjects not directly connected with mining will not be published.*

## Determining Capacity of Electric Mine Locomotive

*Editor Mines and Minerals:*

Sir:—Will some one kindly give a rule for finding the number of cars of coal an electric locomotive will haul up a grade under the conditions given in the following problem:

How many loaded cars can be pulled by an electric mine locomotive weighing 10 tons, equipped with two motors, each 35 horsepower, 250 volts, draw-bar pull 2,700 pounds, speed 7.4 miles per hour, up a 5-per-cent. grade on 40-pound steel rails?

Electrician

## Amount of Carbon Monoxide Given Off by Black Powder

*Editor Mines and Minerals:*

Sir:—I would like to receive through Mines and Minerals some rule by which I can calculate the volume of carbon monoxide (*CO*) which will be given off by a pound of black powder, and also how many shots of 4 pounds each it would be safe to shoot in close workings at once. We are firing shots with a dead fan, that is, a fan running 15 or 20 revolutions, while we have to contend with an abundance of the worst coal dust. We use FF powder.

T. S. Almond

Sutter, Ind. T.

## Tar for Ropes—Breakage of Rock Drills

*Editor Mines and Minerals:*

Sir:—Can you or any of your readers give me any information of value concerning the two questions, viz.:

1. Has Stockholm tar an injurious effect upon steel-wire ropes?

2. The writer has had considerable trouble through breakages of rock-drill pistons. We use 3-inch and 3½-inch machines. The rock bored is fairly hard and very fitchery for dry holes. A new 3-inch piston will last from 2 to 10 weeks, a 3½ inch from 3 to 7 months. The pistons break on the shank either in the chuck or between the chuck and end of cylinder. We weld the broken shanks and these last from 24 hours to 6 weeks and will average about 2 weeks. We did average as low as 1 week but tried another blacksmith with the result of doubling the former average. Have tried both butt and V weld. Distinct evidence of crystallization at times and at others this is entirely absent.

Can any reader suggest any means by which the shank can be made to last longer?

Rock Drill

Queensland, Australia.

## Give the Certified Men a Chance

*Editor Mines and Minerals:*

Sir:—Something has come to my notice in regard to the men in the State of Illinois who have spent years in the coal mines studying the working by different ways of mining and who have the ambition to become at a later day a certified man. In order to improve their condition in the mining world they spend all their spare time after coming home from work studying, and when they think they have mastered the first part of the theory of mining they go before the State Board of Examiners and try to pass the examination for mine examiner. The successful candidate goes home with the ambition to still continue his study in order to try later for mine manager. He may spend a year or two of hard study besides the time he has put in before, and if he succeeds in becoming a certified mine manager he will try to get a position in that capacity. But is a man rewarded by these years of hard study? In many cases he is not, because he is not given a chance to show whether he would be a good man or not. There are too many places filled by assistant mine managers that are not certified men. If the certified men were given these places with the coal companies as assistant mine managers, they would continue to

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