PLAINTIFF'S EXHIBIT
WV-03873

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10/25-00



COAL DUST

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Dust is Dangerous

C. N. DAVIES

with a foreword by
SIR GEORGE BARNETT
H.M. Chief Inspector of Factories

FABER AND FABER LIMITED
24 Russell Square
London

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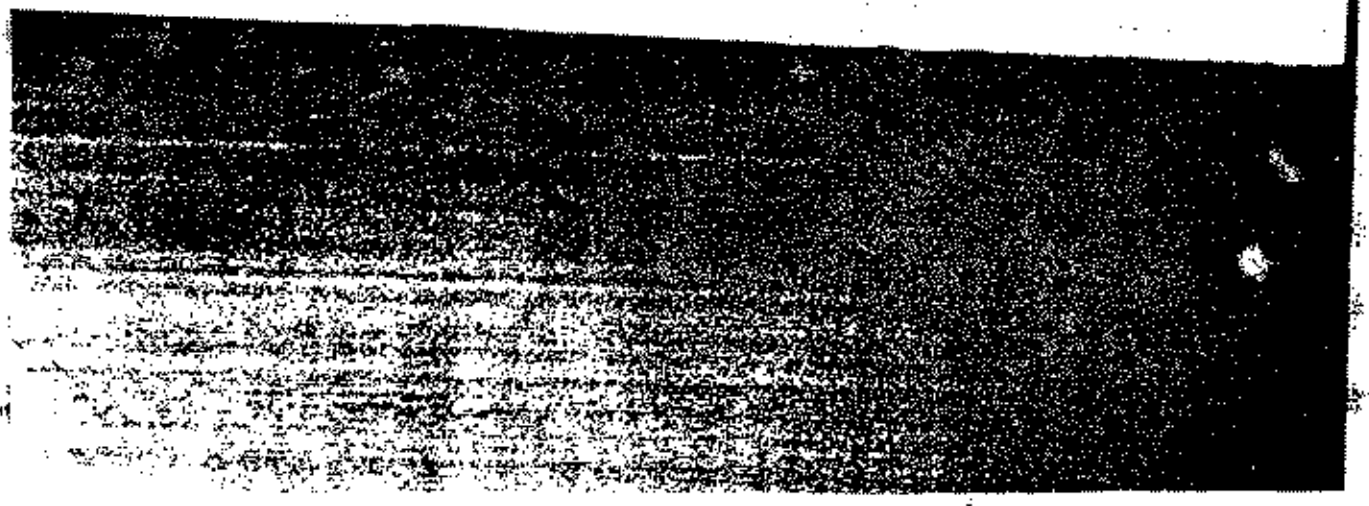

EX 89.E

1. A F Taggart - Handbook of Ore Dressing
Section 11, p1323, 1927 ed.
John Wiley & Sons, London

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must not be forgotten during any readjustments which may affect the pressure on either side); a safer method is to discharge the domestic water into the fire tank from an open pipe.

A minimum pressure of 75 lb. per sq. in. should be provided for the highest fire-hose connection. Mains and principal hydrants should be situated at least 50 ft. outside the mill; near the most hazardous points inside the mill, other connections should be provided for lines of 1¼- or 1½-in. hose, which is as large as one man can handle at adequate protective pressures. Hose permanently connected to outside hydrants, not over 100 ft. in length (but with other 50-ft. lengths at hand), should be of standard 2- or 2½-in. size without rubber. The standard Nozzle for this hose has 1⅛-in. orifice (passing 250 gal. per min. at 45-lb. nozzle pressure), but with the higher pressures available at a well protected mill, orifices of ¾- and 1-in. are sufficient. For the smaller hose, the nozzle opening should be ½-in.

Fire-fighting forces are of little use unless well organized and thoroughly trained by frequent practice. Every member should be instructed in the manner of reporting a fire, use of portable extinguishers, the location of hydrants, the fire-piping system and the inter-relation of its valves, the water resources at immediate command and methods of adding to them. All of this information can be best communicated by printed instructions, as at Tuolumne Butte mill (*116 J 811*), supplemented by regular practice drills with teams so organized that a sufficient number of trained men will be on duty every shift. Suggestions for organization and training are published by the National Board of Fire Underwriters.

Cleanliness, always desirable on general principles, is particularly necessary at those parts of a wooden mill subject to spillage of lubricating and flotation oils. Journals that require frequent oiling should have drip pans or similar devices. Feeders for flotation oils should be similarly equipped. In a small mill, where flotation oils are transferred directly from barrels to the feeders, the area of floor used for this purpose should be covered with sheet iron with raised edges; sand is then spread on the floor, to be shoveled up and replaced as often as necessary.

11. Dust collection

Dust is likely to be produced in troublesome amounts by almost any operation (crushing, screening, elevating, etc.) performed on material carrying less than 7 per cent. moisture. If allowed to migrate freely, it is chiefly objectionable because of disagreeable or unhealthful working conditions, increased abrasion of lubricated bearings, expense for cleaning floors and equipment and possible loss of valuable ore. Motors are the most seriously affected; they can be somewhat protected by grouping in an isolated room and driving the mill by line shaft, or by interposing an extra long shaft between each piece of equipment and its direct-connected motor, which can then be situated in an adjoining and dust-proof room, as in the Symons crushing department at Ajo (*114 J 154*). The most satisfactory method of control is to confine and collect the dust at its sources; the worst dust-producing

Taggart "Handbook of Ore Dressing"
1927

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machines, as a rule, can be enclosed readily with sheet-metal housings connected with an exhaust system, with or without appliances for recovering the dust.

Where collectors have been installed, as at KALGOORLIE, and WAIHI (*114 J 1070*), and at *MORENCI and NACOZARI (117 J 165)*, the value of the dust, which usually assays higher than the original ore, has been more than enough to defray the whole expense of its collection.

Design of suction system. The following points were established at MORENCI in 1917 (*22 CME 207*). The hood should be so designed that the sum of its air inlets does not exceed the area of its exhaust pipe. The exhaust pipe should be attached at that point of the hood towards which the dust is naturally impelled by centrifugal or other forces or by air currents. Connections between the hood and the suction pipe should be by bolted flanges, to permit quick dismantling; other joints in the suction line should be riveted and soldered, with laps in such direction as to cause minimum friction. A velocity of 4000 ft. per min. will carry any ordinary dust. A main header should increase progressively in area, always being slightly larger than the sum of its branches. The system as a whole should be designed to maintain the desired velocities in mains and branches without recourse to valves and dampers for regulation. For straight pipe, 16- or 20-gage galvanized steel is best; on curves, 16-gage. Radius of bends (measured from the center line) should not be less than 1½ times the diameter of the pipe, but there is no advantage in a radius greater than twice the diameter. Unless the headers are equipped with hopper pockets and gates at short intervals, they, as well as all other pipes, should have an inclination of 30° or more (preferably 45°) to allow dust to be withdrawn on stopping operations. The simplest mechanism for recovering dust is a dry cyclone separator; this will catch 75 to 80 per cent. of any ordinary dust. Of the remaining finest particles, 98 per cent. can be caught in a cloth-walled chamber, bag house, or wet centrifugal collector; the expense of a Cottrell precipitator will not usually be justified for this purpose.

At a dry-crushing mill at Kalgoorlie (*114 J 1070*) one 36-in. Sturtevant suction fan, at 1000 r.p.m., drawing 5000 cu. ft. of air per min., collects dust from six large crushers of Griffin, Krupp, or Symons type. Branch pipes are 9-in. diameter; main header, 18-in.; equipped with V-traps and vertical risers for collection of the coarser particles. The dust assays higher than the original ore. It is caught in a cyclone collector followed by a chamber having double walls of fine burlap, with rapping devices, and hoppered bottom with screw conveyor. The original installation at ARIZONA COPPER CO., Morenci, in 1917 (*22 CME 207*), when crushing 250 tons per hr. to ¾-in., the ore averaging 3.85 per cent. moisture, required seven hoods to cover one gyratory and grizzly, two horizontal disk crushers, and two pairs of rolls.—The suction pipes were 8-in. diameter, except that from the gyratory hood, which was 10-in. The wet collector was a cylindrical tank of ⅜-in. steel, 10.5 ft. diameter by 15.5 ft. tall, with tangential inlet near the top. The exhaust, through the top, came from inside a cylindrical shroud, 7 ft. diameter, extending down to within 6 ft. of the bottom of the tank. Water sprays impinged against this shroud, inside and out, and muddy water collected in a concrete basin on which the tank rested, flowing out through a water-sealed trap to flotation. The suction fan, following the wet collector, was a Sturtevant No. 70, exhausting 11,100 cu. ft. per min. at 577 r.p.m., and 3.5-oz. negative pressure; motor input, 23 hp. The dust collected was 0.0367 per cent. of the weight of ore crushed, assayed 2.34 per cent. Cu, and consumed 6552 gal. of water per ton, which was probably more than actually necessary. A later installation by PHELPS DODGE CO. (*117 J 163*) has two similar units each comprising a motor-driven Sturtevant fan No. 80, dry collector and wet collector.—On fairly dry freshly-mined ore, the system collected 8 to 10 tons of dust per shift (80 per cent. from the dry collector), of which 1 per cent. was coarser than 65-mesh and 93 per cent. finer than 200-mesh; its assay was about double that of the original ore. Each wet collector used 10 gal. of water per min. When working on oxidized ore from the stockpile, about twice as much dust, of the same fineness, was collected, its assay being the same as that of the ore. At NACOZARI, a similar but smaller installation collects three tons of dust per shift, produced entirely by coarse crushing, and assaying twice as much copper as the original ore. At a rock crushing plant at CORONA, Cal. (*116 J 889*), trommels are enclosed in jackets connected by suction pipes to two Sly type-A units, each having 3000 sq. ft. of filter cloth and passing 10,000 cu. ft. of air per min. They collect 1.5 tons of dust per hr., coarse particles having been settled previously in a baffled chamber. Suction is stopped for 10 minutes every 4 hours to rap the filters. At UNITED VERDE crushing plant, Clarkdale, Ariz. (*117 J 596*), dust is withdrawn from groups of four jaw crushers, four vibrating screens, four disk crushers, and four rolls, by a separate duct from each group. The ducts have cleaning pockets and gates every 15 ft. Fine dust is caught by plate-and-wire Cottrell precipitators, collected in hoppers and discharged into cars delivering to roasters. A negative pressure of 6-in. water-gage is produced

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by two 45,000-cu. ft. fans, each direct-connected to a 125-hp. motor. At Ajo leaching plant (114 J 164), disk crushers stand above a tunnel containing a belt conveyor on which the crushers discharge; when operating, the ends of the tunnel are closed by doors, and air is exhausted by a suction fan delivering to a group of cyclone separators.

12. Shops, repairs, supplies, etc.

Character of shop work. At an operating mill, shop work is confined almost exclusively to repairs; while a mill is under erection, however, the shops are a most valuable adjunct, and may well be the first buildings set up. A long, simple structure can be partitioned off, the most convenient arrangement being, starting at one end: office, warehouse, machine shop, carpenter shop. Blacksmith work can usually be done most conveniently at the mine shop. The scope of work to be arranged for depends on the size and elaborateness of the mill, and its situation with respect to other established shops capable of doing at least some of the required work. The foundries and machine shops of an enterprise like UTAH COPPER CO., for example, providing for the operation of mines, railroad, and two large mills, compare favorably as to size, arrangement, and completeness with the best industrial machine works. A small mill in an outlying district would be justified in the installation of fairly complete shop machinery, even if not all continuously occupied, so as to save time in repairs and avoid some duplication of expensive mill equipment to guard against delays. Some means of transferring parts of heavy mill equipment into the shop without excessive effort must be provided by car tracks, crane, or both.

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