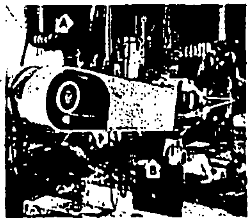

Figure 4. Since this swing-frame grinder is used in a variety of positions, the local exhaust system must be adjustable. The flexible duct (A) permits movement of the exhaust hood (B) as needed. (Courtesy American Foundrymen's Society)

nevertheless, should not be considered as a universal substitute for adequate local exhaust removal, elimination of the contaminant, or containment.

129. Many states and municipalities have dust control codes or ordinances with which employers must comply. In a few states, for instance, written approval of plans must be obtained before a local exhaust system is installed. Each employer should therefore know his state and municipal dust control requirements.

130. Each type of exposure must be considered separately. For example, a local exhaust system suitable for welding or cutting of steel might not be satisfactory for welding or cutting steel coated with red lead.

Local exhaust systems

131. A local exhaust system for the control of an industrial dust or fume traps the air contaminant near its source so that an operator standing at the process is not exposed to harmful concentrations. The system should be designed to enclose the process as completely as possible. This method usually is preferred to general ventilation, but should be used only when the contaminant cannot be controlled by isolation, process revision, or substitution of less harmful materials. Even though a process has been isolated, it may still require a local exhaust system.

132. A local exhaust system consists of four principal parts:

a. Hoods or other inlets, into which the air-borne contaminant is drawn.
b. Ducts, to carry the contaminated air to a central point.
c. Dust and fume collectors, to clean the air before it is discharged.
d. A fan and motor to keep the air moving through the system.

133. While each of these parts should be designed and installed to perform its required function with respect to the system as a whole, design of the exhaust hood demands the greatest care. The degree of control of dust at the point of generation or dispersion is determined by the shape of the hood or degree of enclosure, the location of the hood and its distance from the dust source, and the rate of flow of air into the hood. A poorly designed hood can make an exhaust system ineffective.

134. There is no standard hood. In every case, the hood must be designed to fit the specific operation and to make the exhaust effective without interfering with the operation (Figure 4). Among the factors to be considered are the natural air currents in the room and other exhausts or windows in the area.

135. The hood should be shaped to conform to the shape of the area of dust production so as to secure reasonably uniform air velocity over this area. A hood which does not enclose the process should be placed with its opening as close as possible to the point of generation of the dust or fume (Figure 5) because the velocity of the air in the zone of the hood influence is inversely proportional to the square of the distance from the face of the hood.

136. The hood opening, or part of it, should be located so as to receive directly dust that is thrown off along a well-designated path (Figure 6). The directional energy of the material can thus be used for its own capture. Air movement must always be past the employee, then over the dust source, and directly into the face of the hood.

137. The fan should be of sufficient capacity to maintain the required air capture velocity at the point of generation of the dust. Internal baffles should be installed to guide the air flow where it is most needed. Flanges should be provided wherever possible to reduce the air flow from areas where no dust is produced; that is, air-flow contours should be controlled.

138. Enough air must be supplied to the room from the outside to replace the air that is removed by the exhaust system. Otherwise, there will be interference with other exhaust systems in the area or with gas or oil flames in nearby furnaces. Great difficulty has occurred where an exhaust system caused a slightly negative pressure in a room containing a gas furnace. As a result air came down the furnace flue, and the area became contaminated with carbon monoxide from the furnace.

139. With small exhaust systems, air that is removed usually can be replaced by infiltration flow, but larger exhausts may need a positive air supply (Figure 7). An adequate supply of make-up air, tempered when necessary, is one of the most frequently overlooked fundamentals of ventilation. Air always should be supplied in quantities equal to or slightly in excess of the amounts exhausted.

140. The size of the ducts, the type and size of the dust collectors, and the type and size of the fan and motor (explosion-proof where necessary) are among the other factors which must be considered in the design of an exhaust system. Preventing ignition of a combustible

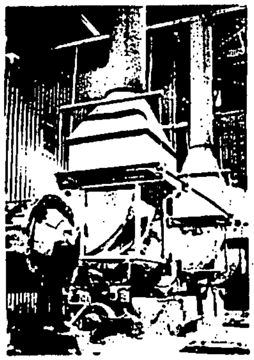

Figure 5. To achieve the proper exhaust air velocity, the hoods for these barrel furnaces can be positioned as close to the furnace spouts as practical. Such positioning is made possible by mounting the hoods on a trolley suspended from an overhead track. (Courtesy American Brake Shoe Co.)

contaminant is a prime safety consideration. Since discussion of the subject of exhaust system design is beyond the scope of this data sheet, an experienced ventilation engineer should be consulted.

141. Also, information can be secured from several excellent publications, one of which is the current edition of *Industrial Ventilation—A Manual of Recommended Practice*, published by the American Conference of Governmental Industrial Hygienists. Another is the chapter entitled "Local Exhaust Systems and Ventilation" in the *Accident Prevention Manual for Industrial Operations*, published by the National Safety Council.

General ventilation

142. Where it is impossible, impractical, or too expensive to control dust entirely by local exhaust systems, general ventilation must be used as a supplement or a substitute. It should be noted, however, that where local exhaust systems can be used, they will always do a better job than general ventilation.

143. General ventilation requires the introduction of enough clean air from the outside to dilute the contaminated atmosphere to a safe level. This method requires larger volumes of air than local exhaust systems to accomplish the same control, and will not be effective uniformly over a large room. It should be considered only when local exhaust systems require such assistance. This is usually where the sources of dust are widely dispersed and each is small.

144. General room exhaust and supply fans must be carefully installed. Eddy currents, which will interfere with local exhaust systems, must be avoided. Employees must not be exposed to excessive concentrations of dust as the dust-laden air moves away from the point of generation, and sufficient makeup air from the outside must be supplied to the room to replace the air that is exhausted. The location and design of the source of supply are important. It is becoming common practice to supply clean, tempered air to the work zone for controlled dilution.

Wet methods

145. Wet dust is not dispersed as readily as dry dust—advantage of this fact should be taken whenever possible. Carloads of dry minerals in some cases may be wetted down before they are unloaded. Aisles in foundries should be wetted down to prevent dispersal of the dust by traffic. Water sprays can be used at some operations. Wet drilling methods can be used for rock drilling to wet the dust as it is formed.

Personal protective equipment

146. Respirators of various designs are available which will give protection against toxic and pneumoconiosis-producing dusts by filtering out the contaminant from the air. The U. S. Bureau of Mines has set up performance standards for dust respirators and gives approval to respirators that meet these standards. It is important that a respirator be used *only* for the particular dust exposure for which it has been approved.

147. Although approved respirators will give excellent protection when properly fitted, they should be used only as supplements to other methods of control or for short or occasional exposures and not as primary controls.

148. Proper fitting of a mechanical filter respirator to the face of the individual is most important because a small space between the facepiece and the face will permit dustladen air to bypass the filter.

149. Respirators must be inspected and cleaned daily. Filters should be replaced before they become so plugged with dust as to seriously increase resistance to breathing. Proper filters for replacement should be available.

Medical program

150. An effective medical control program will help prevent cases of occupational disease. Such a program can also serve as a check on the engineering controls because symptoms of exposure in a group of workers will indicate a failure that must be corrected. The extent of the medical program will depend upon the seriousness of the exposures.

151. An industrial hygiene program should parallel the medical program. Both are essential to protect the health of employees.

152. The physical examination for new employees should include a thorough pre-employment history with the occupational background given in detail. Chest X-rays should be made of all new employees who will be working in dust exposures that could produce disabling pneumoconiosis. The examining physician should decide on placement of those who have pneumoconiosis, active or significant past tuberculosis, abnormally low timed vital capacity, or serious pulmonary diseases.

153. Periodic physical examinations, including chest X-rays, should be made of employees exposed to toxic dusts, fumes, and mists. Such checks can help find incipient cases of poisoning in which symptoms are slight, and the X-rays can pick up early symptoms of lung conditions. Suitable preventive measures can then be taken.

154. Routine periodic clinical examinations, stipple cell counts, porphyrin determinations, and properly evaluated blood and urine lead level measurements, are practical methods for checking employees exposed to lead. If unsafe exposures are found, further environmental control is mandatory. Affected employees should, of course, be given proper medical treatment.

155. Medical controls for employees who work with radioactive dusts must be more stringent than the medical controls for most dusts. An extensive bioassay sampling program is nearly always required.

Other control measures

156. Although the most effective method of control is to prevent contamination of workroom air and thus prevent inhalation of harmful

Figure 6. The centrifugal force created by this grinding wheel causes the generated dust to travel in a well-defined path. To prevent dispersion of the dust, the exhaust hood is placed directly in the dust stream, close to its source. (Courtesy American Foundrymen's Society)