DUST EXPLOSIONS

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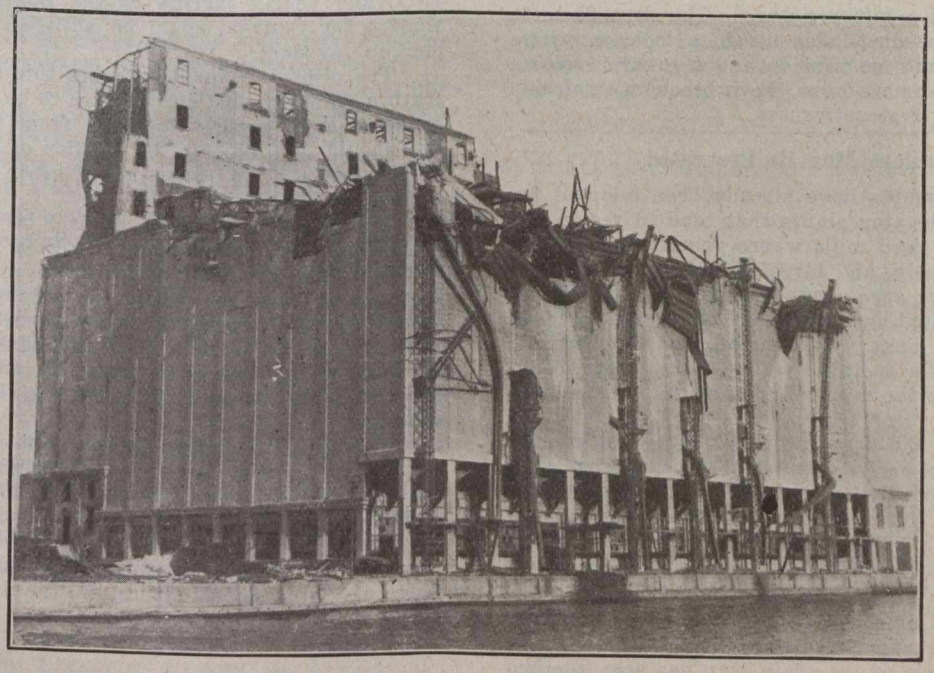
WHEN the cupola of the Canadian government's transfer elevator at Port Colborne, Ont., was completely demolished last summer by a dust explosion, resulting in loss of life and much property damage, as well as heavy losses due to the plant's being out of commission, attention was again called to the tremendous potential destructive forces in dust accumulations.

The explosion at Port Colborne is but one instance of many similar disasters that have occurred during the past decade throughout Canada and the United States. The writer has been keenly interested, from an engineering point of view, in the problems of dust extraction and disposal, particularly those met with in grain elevator plants, and has had opportunities of supervising the installation and checking up the actual performance of dust-collecting systems in the elevator plants most recently erected at the head of the lakes and on the Canadian prairies, and he is of the opinion that the systems installed do not adequately take care of the situation.



Port Colborne Grain Elevator After Dust Explosion

Undoubtedly, these systems perform the functions for which they were designed—namely, to collect the dust and chaff from the grain during cleaning operations, to dispose of it to a dust bin (either in or outside the building), and to provide a means for the removal of sweepings from the floors. But this is not enough. The constant discharge of large quantities of dust into the atmosphere on the various work floors throughout a plant should be prevented.

This dust, settling on the exterior frame of the building, on the spouting and on the machinery, often is allowed to accumulate for years, storing up the fuel supply for the flame of a dust explosion. To-day the conservation of food supplies, of property, and of life itself demands the attention and support of all interested parties towards the determination of the most efficient and practical methods of preventing dust explosions.

The United States government, through the medium of its department of agriculture, is at present carrying on an active educational campaign by pamphlet and lecture tours, dealing with dust explosions and preventive methods. Our own government should put its shoulder to the wheel and take the full share of its responsibilities in this important matter.

Dust explosions occur principally in industrial plants of the following types: Grain elevators, feed grinding plants, flour mills, starch works, sugar refineries, wood working industries, coal mines and coal-handling plants, breakfast cocoa plants (chocolate dust), and paper mills.

Explosions are due to the dust in air coming into contact with an external source of ignition, under favorable temperature and humidity conditions. The factors that combine to give explosions of destructive violence are briefly as follows:—

1. Degree of fineness of dust particles. Susceptibility to ignition increases as the fineness of the dust particles in suspension.

2. Moisture content of dust. Dampness retards and dryness expedites rate of flame propagation.

3. Atmospheric conditions. Periods of high temperature and low humidity are most favorable for dust explosions.

From this it follows that fine dry dust such as grain elevator dust, coal dust, starch dust, sugar dust, etc., in suspension in a large volume of air, will, under certain conditions, ignite with ease and explosive violence.

The sources of ignition, which investigations have proven conclusively to have caused explosions, come under the following classifications:—

1. *Open Flame.* Striking of a match, pipe smoking, etc.

2. *Mechanical Causes.* (a) Choke-ups in elevator legs where the head pulley keeps turning inside the belt until the temperature produced by the resulting friction passes the ignition point. (b) Hot bearings and belt slippage.

3. *Electrical Causes.* (a) Sparks from motors. (b) Blowing of fuses. (c) Open switch throwing. (d) Carbon lights (old type incandescent lighting).

4. *Static Electricity.* A large percentage of dust explosions have had as their ignition factor static electrical discharges. Static currents, with voltage as high as 50,000 volts, have been recorded in the operation of grain threshers. It has been stated that during a single crop year in the western United States, four hundred explosions resulted in connection with threshing operations. Investigations proved that these smut-dust and grain-dust explosions were caused by static electricity igniting the dust-laden air. The friction of the straw over the teeth in the cylinder on the shaker shoe and in the exhaust fan, created the current, and the proper grounding of these danger zones eliminated further trouble. Static electricity frequently manifests itself in elevators during elevator leg and conveyor belt operations.

5. *Spontaneous Combustion.* The slow process of destructive distillation or charring that is commonly known as spontaneous combustion, has been looked upon by indifferent investigators as the cause of many dust explosions, but no case as yet has been found directly attributable to this reaction.

Theory of Dust Explosions

The ignition point of dust particles varies. Some ignite at lower temperatures and with greater speed of propagation than others. Glowing red heat will ignite sugar dust, ranking this particular type as one of the most inflammable.

Of the percentage of dust that must be in suspension in order to create an explosive mixture, certain available data give a fair idea. It is a well-known fact that fire-damp explosions in mines and tunnels occur when the percentage methane in the air lies between 5½ and 14%. With mixtures outside these limits the menace does not exist.

Coal-dust explosions require a dust suspension of from two to three hundredths of an ounce per cubic foot of air