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lation systems to insure optimum performance and worker protection.

- Major R&D for air cleaning equipment is needed to improve the overall capability of the equipment. Laboratory and particularly field investigations are needed to evaluate the performance of such equipment in the context of recirculation systems. The control equipment industry needs to concentrate on filling research gaps. Both test procedures and performance data need to be established to define the capability of ACE in industrial applications.

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## Controlling Cotton Gin Emissions

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Since cotton today is machine picked, the mere process of ginning creates a significant amount of trash and dust. A large cotton gin in Fresno operating at 23 bales per hour uses two rotating filters to control this material. Total emissions from the facility are in the order of 50 pounds per hour, or about one-half the emissions from a typical gin using cyclones as control equipment.

In 1792 Eli Whitney invented the saw type cotton gin which was the beginning of the ginning industry. That industry today has grown to over 2700 cotton gins. The 1977 crop totalled 14.3 million bales of cotton valued at \$3.6 billion.

Associated with cotton ginning are particulate emissions that directly relate to the soil type and weather conditions, cultural and harvesting practices, moisture and trash contents, and the ginning processes. Uncontrolled, these emissions can vary greatly depending on gin capacity. Small gins turn out 1000 bales/season while large gins produce up to 50,000 bales/season. Today virtually all gins use cyclones, at 90% efficiency or less, to control ginning emissions.

One large gin in the San Joaquin Valley has unique control equipment. This gin was constructed in 1977, is in the 50,000 bale/season class, and uses a rotating filter system to control emissions. Particulate emissions from the cotton ginning process come from a multitude of areas throughout the process. The flow along with particulate discharge locations are shown in Figure 1.

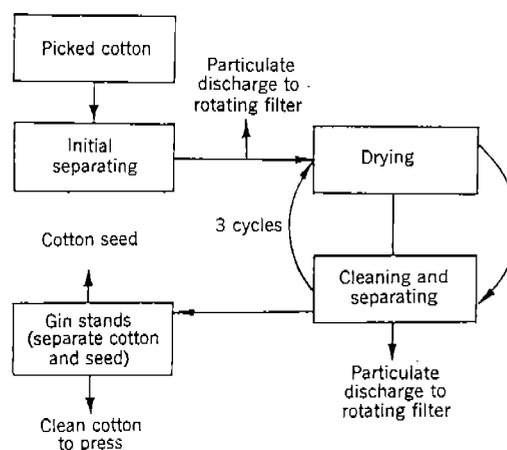


Figure 1. Cotton ginning.

This gin, which was tested in December 1977, has 3 cleaning and drying cycles, as well as 3 gin stands. All discharge points are ducted to rotating filters where the air is cleaned and the trash conveyed pneumatically to a trash area. This gin trash can then be plowed back into the fields or disposed by other means.

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**Filter Operation**

The trash collecting system is composed of a settling chamber and a pair of rotating cylindrical drums. The drums are covered with a mesh type filter media where the lint fly accumulates. As the drums rotate, a line of vacuum nozzles spanning each drum continuously removes the accumulated lint fly. Heavier trash particles fall out and are collected in a trash hopper below the drums. Material vacuumed from the drums is conveyed pneumatically along with the trash from the trash hopper to a pair of high efficiency cyclones where final separation occurs in the trash collection area. Figure 2 shows the component arrangement of the system. Two rotating filters with two pairs of cyclones are employed to filter all discharge air at the cotton gin.

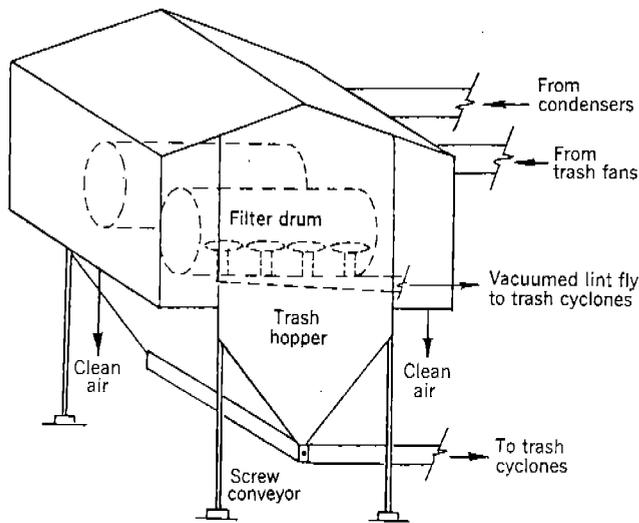


Figure 2. Filter components.

**Testing**

Source testing was performed to determine emission compliance of the two control devices and the trash conveying system. Emission compliance was based on 5 source operations for process weight emission rate, 95.8 lb/hr and 0.10 grains/standard cubic foot for emission concentration. Due to the unusual design of the collecting system, ducting had to be designed and constructed to enclose one of the two rectangular filter exhausts. Back pressure problems required baffling on the opposite exhaust to balance the flow from the filter. The trash cyclone was tested with a standard "candy cane" setup.

Actual testing was performed using a modified Method V of the U.S. Environmental Protection Agency. This modified method accounts for particulate matter collected in the front half of the sampling train (probe and filter) as well as the back half (impingers). The filters used were preweighed, 4 in. diameter, fiberglass type, with a collection efficiency of 99.97% for particles greater than 0.3 microns in size. Methods of analysis follow guidelines established by the California Air Resources Board and the Environmental Protection Agency.

Testing was performed 10 diameters downstream from the last disturbance in both the filter and cyclone with flows in the filter and cyclone remaining relatively constant. Since

Table I. Test results and total gin emissions.

	Filter No. 1	Filter No. 2 <sup>a</sup>	Trash Cyclones (4)
Emission	12.98 lb/hr	14.86 lb/hr	11.83 lb/hr
Concentration	0.022 gr/scf	0.022 gr/scf	0.059 gr/scf
Flow	68,836 cfm	78,791 cfm	23,400 cfm
Total gin emissions	39.67 lb/hr		

<sup>a</sup>Filter No. 2 was not tested. The emissions here are estimated from testing performed on filter No. 1. This is a conservative estimate since the No. 1 filter handles lighter/smaller particles.

isokinetic sampling methods were employed, the stack gas concentration of particles is assumed constant. Table I summarizes the test results and total plant emissions. Operation of the gin during testing averaged 23 bales/hour.

**Summary**

$$39.67 \frac{\text{lb}}{\text{hr}} \times \frac{1 \text{ hr}}{23 \text{ bales}} = 1.725 \frac{\text{lbs}}{\text{bale}}$$

Emission standards in Fresno County are 0.10 gr/scf and 95.8 lb/hr for a gin processing 23 bales/hr. This gin, with rotating filter emission control equipment, easily meets Fresno County's Pollution regulations with concentrations less than 0.10 gr/scf and total emissions of 39.67 lb/hr. The system effectively replaces the more common cyclone collectors, inline air filters, fine mesh condenser screens, and skimmers while providing an estimated filtering efficiency in the order of 95%.

This initial test indicates that the rotating filter trash collecting system can effectively control cotton gin emissions. As the ginning industry looks to alternate means of emission control, the rotating filter system should be able to meet those demands.

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**Explosion Protection in Dust Control Apparatus**

This was the topic of a well-attended symposium sponsored by the Industrial Gas Cleaning Institute on March 28-29 at the Marriott in Rosslyn, Virginia. The causes, as well as the cures, for explosions in control equipment, especially baghouses, were explored in depth.

The extensive and intensive studies conducted in Germany both by Mikropul and by the German Institute of Coal Mines were reviewed. Dust explosions, it was noted, occur when three requirements are satisfied. These are: 1) suitable explosive characteristics of the dust—a combustible dust suspended at suitable concentration, 2) a needed oxygen concentration, and 3) an ignition source. Furthermore, particle size as well as dust concentration has a marked influence and, of course, some dusts are far more prone to detonation than others. When these explosive criteria cannot be controlled adequately, then four practices may be employed to minimize the problem. *Suppression* can be achieved by controlling dust or oxygen concentration or by using flame extinguishing powders, etc. *Built-in protection* may also be provided. *Containment* may be realized by a suitably high pressure resistant type of construction. *Relief* doors may also be employed to dissipate high pressure, explosion products.