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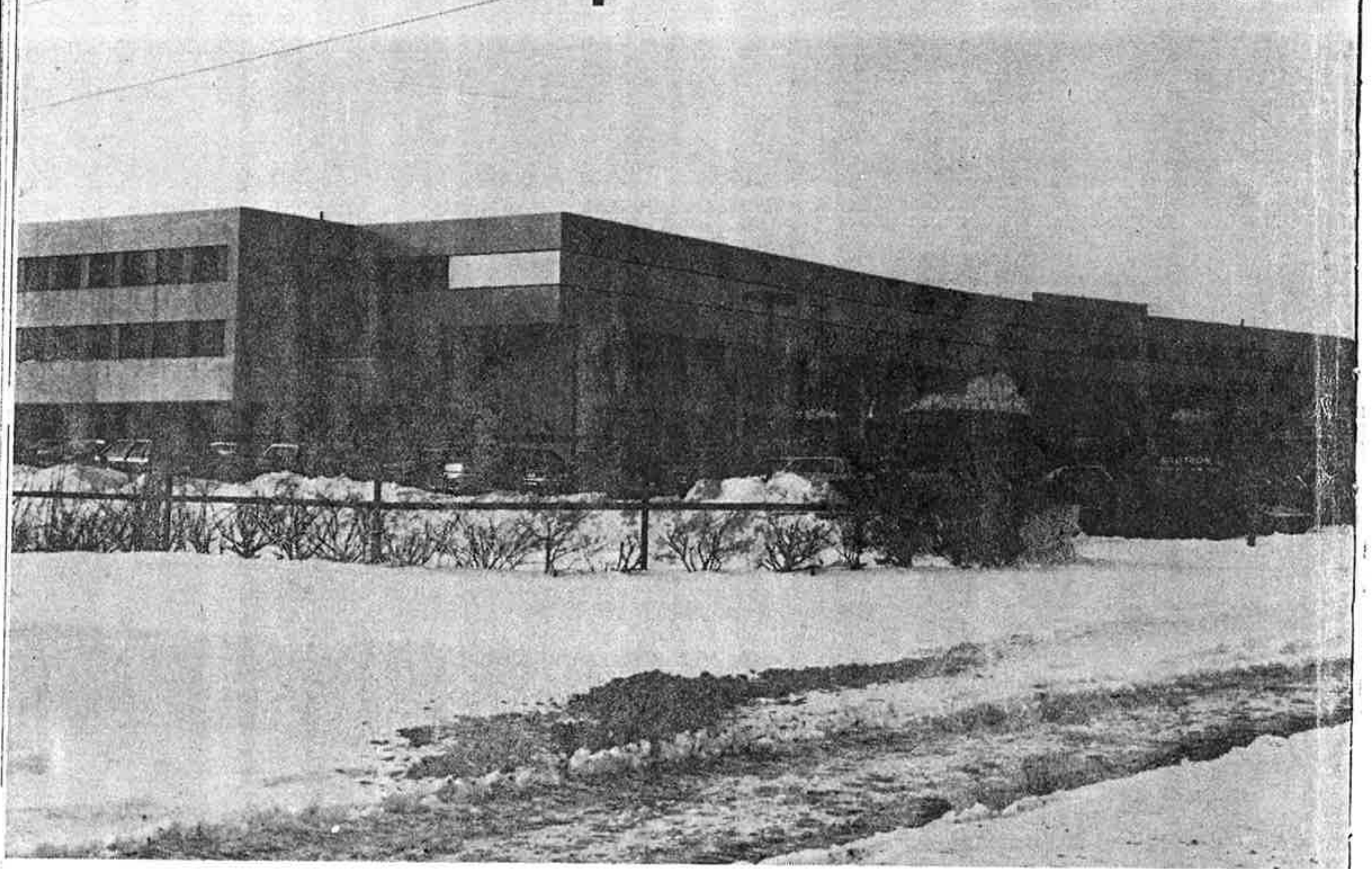
Mt. Sinai Medical Center: A New Concept in Smoke Control



LEONARD BILLINGS
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Smoke control is a vital aspect of fire protection. This is particularly true when the fire involves synthetics that drive off great volumes of smoke and toxic gases even before a flame becomes visible. Some materials not only burn rapidly, they emit large quantities of smoke particles that could render escape impossible. Today's buildings are reasonably fire resistant, and seldom structurally weakened by fire. The mechanical systems, however, suffer heavy damage or are destroyed along with other property, and the human toll is all too often high. Recent fires have underscored this sad reality: a building may have enough exits for normal traffic, yet they can become death traps when smoke billows through them and makes breathing impossible. Sprinklers, on the other hand, require substantial heat and fire before they will activate. Furthermore, they don't control smoke. In fact, sprinklers can cool the smoke, cause larger smoke particles to develop and completely obscure passage or fire-fighting attempts. The alternative: Designed smoke control systems that move heated, gas-laden smoke out of a building without obscuring exitways and corridors, and prevent people from anxious or panic-stricken action.

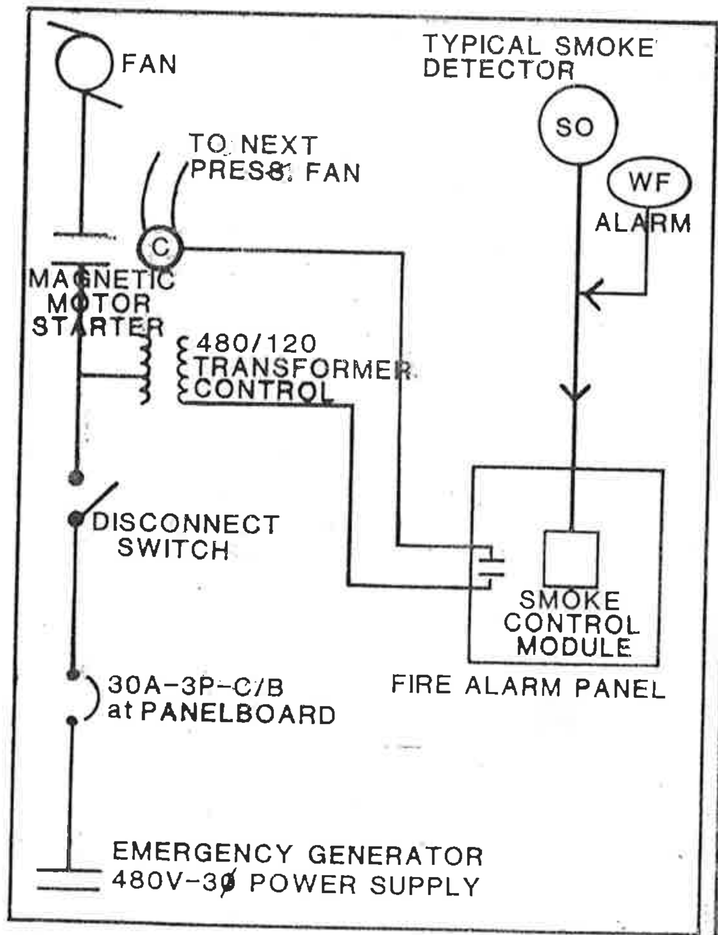
THE city of Beachwood, Ohio, under Fire Chief George Vild has done something about smoke control in every building being built in our booming suburb. If the building is over 35 ft, it is equipped with a special smoke control system along with a complete package of other fire control systems. These include early warning systems and alarms preconnected to the fire department, sprinkler networks, where necessary, special elevator controls, direct fire personnel telephone systems throughout the building and emergency power.

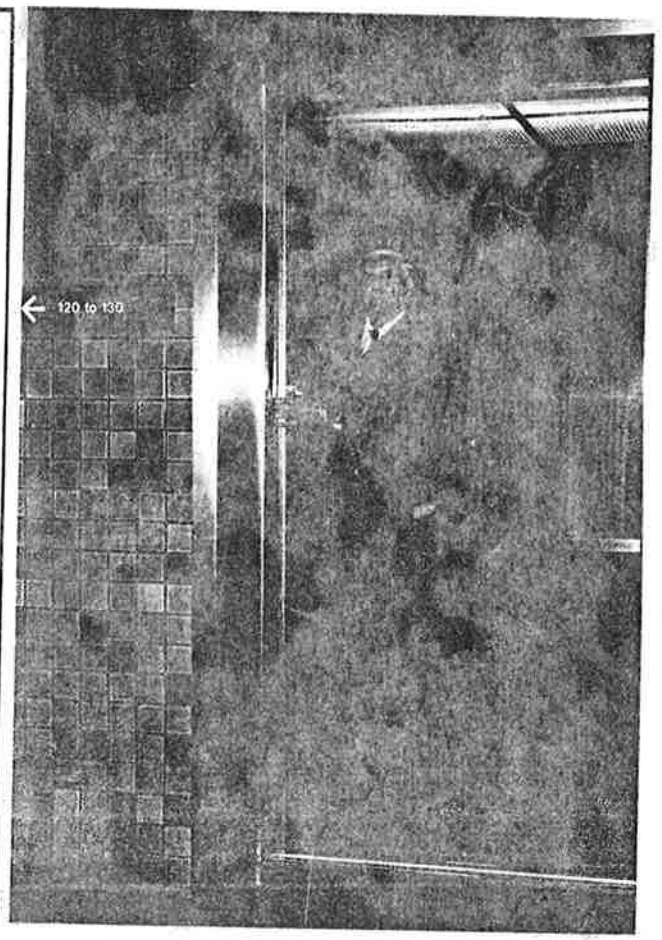
An outstanding example is the new Mt. Sinai Medical Building. Completed in 1980, the 3-story building contains 36,892 ft^2 per floor or a total of 110,676 ft^2. There are two stairwells, one at each end, and three elevator shafts, each with its own fan, all pressurized. Each corridor is further separated into three zones with smoke and fire doors, so that when an elevator door or stairwell door is open that part of the corridor is also pressurized.

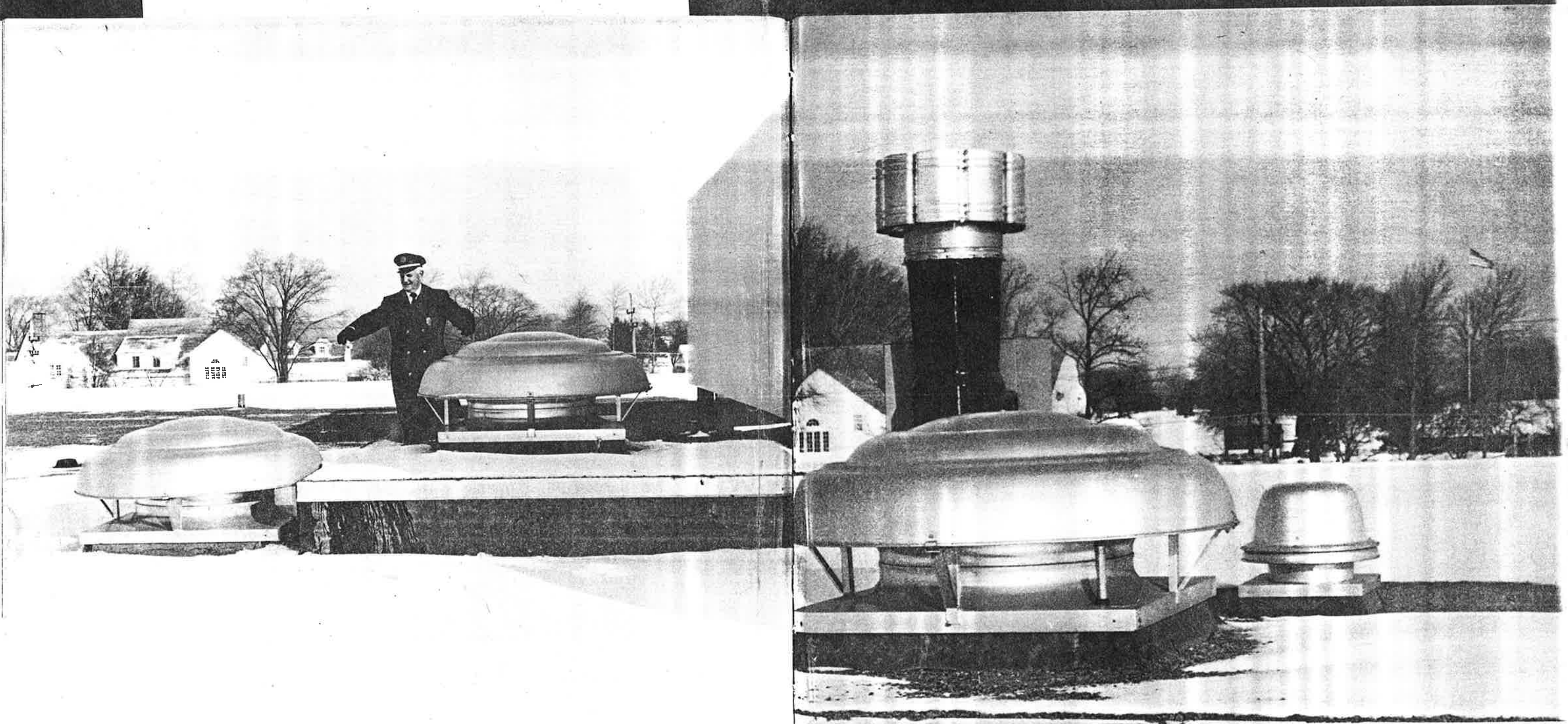
Mt. Sinai Medical Center occupants include doctors' offices and ancillary services. A drugstore is located off the main lobby.

Fans used for stairwell and elevator pressurization are located on the roof. Separate fans are used for each stairwell or shaft. (3,000 cfm constant

Fire Marshal Billings







speed, belt drive, .5hp). The five fans cost approximately $750 per fan. The total cost of the system was $5,750 or less than 6¢ per square foot.

TEST

On September 16, 1980 a test of the system was made to verify pressure differentials with the building doors and elevator cars in different modes. The building was in use and no attempt was made to restrict normal movement. Among those present during the tests were the author and Robert E. Taylor, Chairman ASHRAE TC 5.6, the Committee on the Control of Fire and Smoke.

A Magnahelic Gage was used to test pressure differentials with doors closed. A Dwyer Vaneometer was used to measure air flow through open doors at three levels, yielding 1 fpm from the top, 3.5 fpm from the floor and 1 fpm off the floor. The Beachwood Code calls for the pressure differential with doors closed to be 0.05" water gage and not to exceed 0.15" water gage. A 10-15 mph wind was blowing from the southwest and the temperature was between 65 F and 70 F.

In all cases where doors were shut on all floors with the system operating, pressure differentials were 0.05" or higher. The highest pressure recorded was 0.07" on the first floor of the East wing. Excellent results were recorded in both stairwells and elevator shafts.

With doors open, all air flows were positive from the stairwell or elevator shaft to corridors. In some cases, as building occupants opened and shut doors during normal movement, air flow dropped off to as little as 50 fpm. Measurements were taken from the hinge side of the door. Findings include (T = Top; M = Middle; B = Bottom):

1st floor—doors closed:
T—.055 fpm
M—.05 fpm
B—.06 fpm
1st floor—doors open:
T—175 fpm
M—160 fpm
B—150 fpm

With first and second floor doors open, flow dropped to an average of 80 fpm across the first floor door. It is interesting to note that with one smoke door open to the first floor corridor, air

flow within the corridor space was 50 fpm uniformly across the door.

The West elevator findings were typical of all the elevators (doors closed on all floors: 0.05" wg; measured first floor—car on 2 w/doors open: 0.05" wg). Positive air flows from shaft to corridor were as follows:

1st floor—doors open:
T—150 fpm
M—150 fpm
B—400 fpm
3rd floor—doors open:
T—50 fpm
M—75 fpm
B—300 fpm
2nd floor—doors open:
(Same as 3rd floor)

Air flow readings with the central elevators where both car doors were open on the first floor and both outdoor lobby doors showed an air flow through the elevator doors of 150 fpm. The East elevator has scissor doors and is designed to handle stretcher patients. Again, flow readings only were taken with this elevator except on the first floor with the car on the first floor.

1st floor—doors closed:
T—.07" wg
M—.07" wg
B—.07" wg

Air flow rates in the third floor corridor with corridor smoke doors closed was approximately 75 fpm with the elevator door open on the first. Measured on the first floor five feet inside an office, the flow from the corridor into the office was positive at 25-80 fpm.

The system works and the Beachwood Fire Department knows how to use it. It is frustrating that it has taken so long for engineers, architects, builders and code and fire officials to realize that so many of the problems of smoke and fire can be dramatically reduced by following sound smoke control design. Be it the MGM Grand Hotel, the Beverly Hills Supper Club, or a recent five-story apartment fire in Cleveland, failure to recognize the role of pressure differentials in fires has led to disaster. Beachwood believes major losses due to smoke movement are unnecessary.

One final point. Testing of systems is critical. Even more critical is the training of the fire service on the use of these systems. Effective smoke control can help reduce the tragic loss of life. □□