FLY EXCLUSION FANS
CHAS. L. SENN, NORMAN R. EHMANN,1
SEYMOUR BARFIELD AND JOHN C. RUDDOCK
Los Angeles City Health Department, Los Angeles, California

Food establishment codes frequently suggest or require fly exclusion fans. A familiar example is the requirement given in the current Ordinance and Code Regulating Eating and Drinking Establishments Recommended by the U. S. Public Health Service, which states: "Where flies are prevalent, all openings into the outer air shall be effectively screened and doors shall be self-closing, unless other effective means are provided to prevent the entrance of flies"; and under "Satisfactory Compliance" the code requires, "Fans of sufficient power to prevent the entrance of flies in use at all otherwise in-effectively protected openings."

The Los Angeles Building Code chapter on food establishments authorizes fans in lieu of screens "when approved as to size and location by the Health Department."

For the past several years observations and studies were made by the environmental health staff to determine whether fly exclusion fans are effective and, if so, under what installation and operation conditions.

TYPES OF FLY EXCLUSION FANS
The three most common type fans for fly exclusion are:
1. High velocity fans located above entrances and pointed in various directions with diameters ranging from 10 to 30 or more inches and speeds from 700 to 1390 rev/min. Many produce blasts of air objectionable to customers.
2. Air currents produced by centrifugal or squirrel-cage-type blowers discharging through slots to produce a narrow, high velocity current of air over the entire opening.
3. Conventional overhead, horizontally rotating, paddle-type fans with diameters ranging from 36 in. to 52 in. and speeds from 175 to 340 rev/min.

EXPERIENCES AND OPINIONS OF OTHER AGENCIES
Opinions and comments were obtained by writing to a considerable number of agencies. Selected responses may be summarized as follows:
The American Institute of Baking reported fans are quite unreliable; that while they work reasonably well in some cases they fail completely elsewhere. Prevailing winds and drafts can completely nullify the effects of the fan.

The National Dairy Products Company reported they had "completely satisfactory information" to the effect that fans installed within the plant and either blowing outward through openings or downward across openings are not only ineffective but sometimes facilitate the entrance of flying insects and airborne debris. They concluded that the only effective fans are those which produce a curtain of highspeed air across the opening.

The National Confectioners Association reported fans installed inside or outside the door "with blades rotating parallel to the floor are useless. Air currents are created that would assist flies through the door. The most effective method is to install a fan inside the doorway, high enough to avoid traffic, and directed toward the doorway at about 35° to 40° from the vertical so all corners of the door are covered with a barrier of moving air."

EFFECT OF FAN INSTALLATIONS
Los Angeles field studies showed there was no significant difference between fly populations in food establishments where "fly excluding" fans were operating over doors and those places not having or using fans. Of the 118 restaurants, retail bakeries and markets included in the surveys the following observations were made:

<table>
<thead>
<tr>
<th>No. establishments</th>
<th>Condition</th>
<th>Flies presenta</th>
<th>Flies absentb</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>No fan</td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td>40</td>
<td>Fan not operating</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Fan operating</td>
<td>22</td>
<td>16</td>
</tr>
</tbody>
</table>

*Significant number of flies in establishment
bNo significant number of flies in establishment

FOUR-BLADED PADDLE FANS
One of many 4-bladed paddle fans was observed at the doorway to a school cafeteria. A 36-in. diameter, 3-speed, 4-bladed paddle fan was installed inside, near and above the doorway. With the fan operating at maximum speed, velocimeter measurements showed air velocities to range from near 0

---

1Present address: Neil A. Maclean Co., Inc., 9846 E. Alpaca, El Monte, California.
near the floor to an average of about 200 ft per minute at the center. It was noted that even when this fan was operating at high speed, flies flew into and out of the building in a random pattern.

While these observations seemed to show that this type fan is nearly useless, other observations clouded the question. A paddle fan at a school cafeteria was installed in an 8-ft. wide corridor 10-ft. inside from the open door and near the door to the kitchen. For a period of nearly one-half hour flies were observed to enter the corridor but all turned when they reached the fan's air current; none passed through to the kitchen during the period of observation.

Many observations by department sanitarians resulted in general agreement that paddle-type fans tend to reduce the number of flies on meat blocks in “open-front markets.”

**Higher Air Velocities**

In their earlier observations a propeller fan was installed above a doorway so as to produce an air current downward and outward of 600 lineal ft/min at the middle of the doorway. Raw and cooking garbage was placed inside to serve as a fly attractant. An enclosure was built outside the door into which “blow flies” and “house flies” were released. The air movement induced by the fan tended to push the flies downward but they were attracted by the garbage and did pass through the air currents in substantial numbers. When garbage was placed directly under the fan flies alighted on the garbage and stayed there in spite of the air current.

More recently a series of observations were conducted in an area with a fairly heavy fly population. At one dairy a fan was installed 1½ feet inside and above a milkroom doorway, pointing downward and outward. The air velocity was 1400 ft/min 6 ft from the floor, 600 ft/min 3 ft from the floor and 400 ft/min at the floor. Flies were entering under these conditions.

At a second dairy the fan was installed above and 3 ft inside the milkroom door, directed downward and outward at an angle of 45°. Air velocities were 1000 ft/min at 7 ft above the floor, 600 ft/min at 5 ft, 400 ft/min at 3 ft and 150 ft/min at the floor. Flies were entering.

At a third dairy a fan had been installed at an angle of 45°, 1 ft inside the doorway, and was producing a velocity of 1600 ft/min at 5 ft above the floor, 1200 ft/min 3 ft above the floor, and 800 ft at the floor. No flies were entering. The doorways in these observations were not normally and routinely used by customers as a means of ingress and egress. The high velocity air current would be objectionable to some.

**Recent Observations and Conclusions**

Based upon all observations it is concluded that except for unusual inside applications paddle-type fans as normally installed are of little value as fly-exclusion devices. To be effective the fan must produce a fairly high air velocity. Effectiveness is also related to the location of the fan and direction of the air stream. At the school mentioned above the fan was effective because it was installed inside a corridor 10 ft from the entrance. Such fan location is not normally practical. Fans installed outside of doorways frequently do not produce enough velocity to overcome normal wind currents. Fans installed outside and blowing downward and inward may tend to help bring flies in.

Studies in Los Angeles on how to interpret the housing code regarding screening windows showed that the tendency of flies to enter a room is directly related to whether there are fly-attracting odors in the room. Screens may not be needed on windows of hotel sleeping rooms but are needed on kitchens or “light-housekeeping” rooms where food tends to attract flies. It was noted that screen doors are not 100% effective, and that screen doors are apt to be kept open long enough for flies to enter. So, it cannot be expected that any means will do a 100% job of fly exclusion when a door is routinely used for ingress and egress.

The question is, what fan characteristics are requisite for reasonably reducing the number of flies that may enter through food establishment doors under normal conditions? It was concluded that a fan producing a velocity of at least 1600 ft/min near the fan (nearly 19 mph) and at least 750 ft/min over the whole doorway down to within 3 ft of the floor, installed inside and just above the doorway, directed downward and slightly outward, does significantly discourage flies from entering; that the effectiveness of the fan increases or decreases according to the extent and direction of external natural wind currents and the ventilation systems, air conditioning and other factors within the establishment. It was determined that fans are not a satisfactory substitute for screen doors of kitchens, on rear or side doorways which are normally kept open for ventilation in hot weather.

It was further determined that fans should not be required on doors which are normally closed except when used for entry. This is especially true of automatically operated doors of supermarkets.

**Fly Exclusion Fan Policies**

In accordance with the Department policies the Los Angeles Food Sanitation Advisory Committee reviewed the entire subject. Participating in the
deliberations were representatives of the pest control industry, fan manufacturers and distributors, market designers and builders, food industry representatives, and construction and equipment specialists of the school board.

The group concurred in the Department's conclusion that ordinary 4-bladed paddle fans or other devices that do not produce a "blast of air" are not normally effective as fly exclusion devices. They recommended that the fly exclusion begin with external fly control and include other steps, as follows:

1. Community fly control.
2. Eliminate fly-attracting conditions near entrances to food establishments.
3. Apply exterminating procedures near or on entrance doors and doorways.
4. Investigate effectiveness of fly-repelling materials and devices.
5. Eliminate requiring fans where they are not of real value.
6. Eliminate such means of fly ingress as damaged screens, unscreened air vents, etc.
7. Apply approved fly extermination procedures inside the establishment.

**Fan Standards**

To interpret the Building Code section which authorizes fans in lieu of screens "when approved by the Health Officer" the following policy was adopted:

"Where fans are required they shall be installed inside the building with the air flow downward and outward to produce a minimum velocity of 750 ft/min over the entire opening, down to 3 ft above the floor."

**Exceptions**

1. Fans shall not be required under the following conditions:
   (a) Doors are self-closing and will normally be kept closed at all times except to allow passage.
   (b) Doorways to establishments where there is no unpackaged, exposed food except fresh fruits and vegetables.
   (c) Doorways or large openings to loading areas not normally used for storing or preparing unpackaged foods.
2. Other fly exclusion devices or alternate fan locations should be submitted to the Health Department for approval before installation.

Fans will not be accepted in lieu of screens on side or rear doors to food-processing rooms.

---

### PROBLEMS OF WAREHOUSING AND STORAGE OF FROZEN FOODS

**HUBERT M. ABONS**

*Hartford Freezer Corporation*

_Hartford, Connecticut_

The proper storage and handling of frozen foods in public refrigerated warehouses require a combination of ingredients all working together. Among these are good physical facilities, efficient handling equipment, well-trained employees, well-organized procedures, the knowledge and experience of the warehouseman plus an acute sense of service and responsibility.

One of the peculiarities of the public refrigerated warehousing industry is that it is very difficult to point to any one aspect of it and say that this is "average" or "typical" of the entire industry. Certainly this is true of the physical facilities such as the refrigerated warehouses themselves and the equipment in them. There has, of course, been a strong trend toward the single story warehouse since the last war, but there are still some strong advocates of the multi-story plant in certain situations. Some plants are sort of a combination of the two, making use of balconies or basements. One new plant I know of has a split level design and you can even find a modern river front refrigerated warehouse built on stilts to place it safely above possible flood waters. Generally, design is largely dictated by the service requirements of the customers the warehouse serves.

A refrigerated warehouse may be located in an area of production where it serves growers, processors, and packers and handles large unit quantities in and out. It may be located in a large urban area and performs primarily a distribution function. Another warehouse may be so located that its business is mostly storage of goods in transit. Still another warehouse may be a combination of those types.