(7/8-cooling time). This is particularly important during busy periods when it may be tempting to "push" product through the precooler. A correctly-sized precooler should have sufficient capacity so as to provide adequate resident time for precooling, while at the same time not slowing subsequent packing and/or handling operations. The cooling medium (air) must be maintained at a constant temperature throughout the cooling period. If the refrigeration system is undersized for the capacity of product requiring precooling, the temperature of the medium will increase over time. The cooling medium must also have intimate contact with the surfaces of the strawberry. Inappropriately-designed containers can markedly reduce flow of the cooling medium.

The cooling rate is not only dependent upon time, temperature, and contact with the commodity; it is also dependent on the cooling method employed. As noted above, most strawberries in Florida are forced-air cooled. Hydrocooling (showering or immersion in chilled water) is not recommended because wet berries are much more susceptible to decay. Cooling with crushed or slush ice is even worse because the berries are likely to sustain physical damage. Vacuum-cooling would produce critical moisture loss and procedures using water spray could not be used. Again, room-cooling of strawberries is not an acceptable precooling method nor is reliance on refrigerated trucks during transit.

Forced-air cooling (pressure cooling)

Forced-air cooling, which has been described in detail in various publications, can solve many difficult cooling problems because it provides for cold air movement through, rather than around, containers. The system, which creates a slight pressure gradient to cause air to flow through container vents, achieves rapid cooling as a result of the direct contact between cold air and warm product. With proper design, fast, uniform cooling can be achieved through unitized pallet loads of containers. Various cooler designs can be used, depending on specific needs. Converting existing cooling facilities to forced-air cooling is often simple and inexpensive, provided sufficient refrigeration capacity and cooling surfaces (evaporator coils) are available. Some variations in forced-air cooler design are described here.

Forced-air tunnel

This is the more traditional forced-air cooling system. Essentially, two rows of palletized containers or bins are placed on either side of an exhaust fan, leaving an aisle between rows. The aisle and the open end are then covered to create an air plenum tunnel (Figure 1). With the exhaust fan operating, a slight negative air pressure is created within the plenum tunnel. Cold air from the room then moves through any openings in or between containers toward the low-pressure zone, cooling the product as it moves. The exhaust fan can be a portable unit that is placed to direct the warm exhaust air toward the air return of the cold room, or it can be a permanent unit which also circulates the air over the cooling surface and returns it to the cold room (Figure 2).

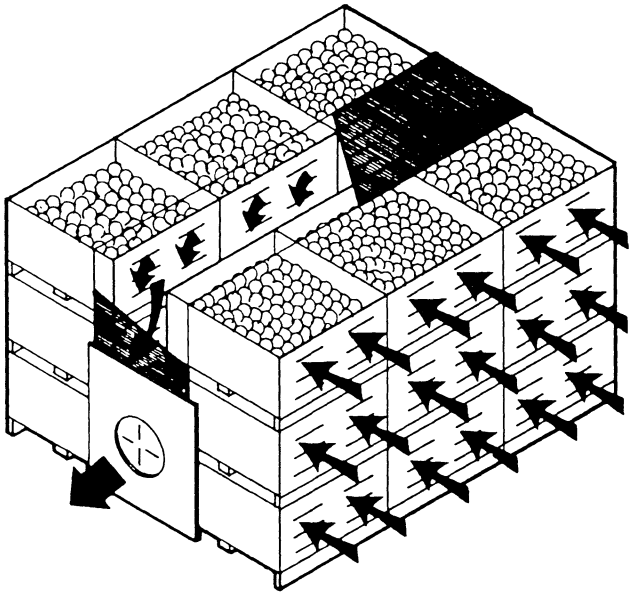

Figure 1. Forced-air tunnel with portable exhaust fan.

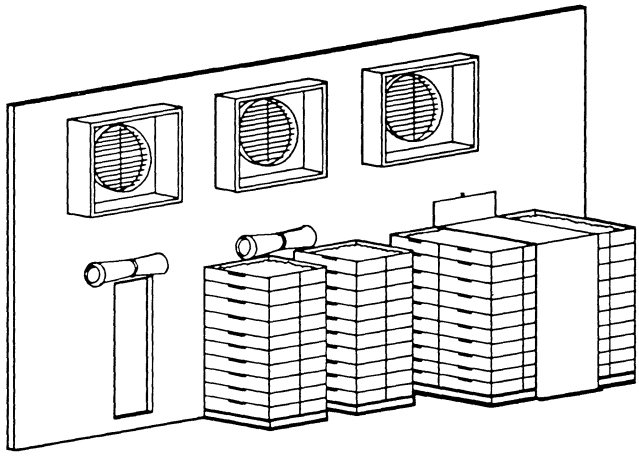

Figure 2. Forced-air cooler with permanent constructed air plenum.