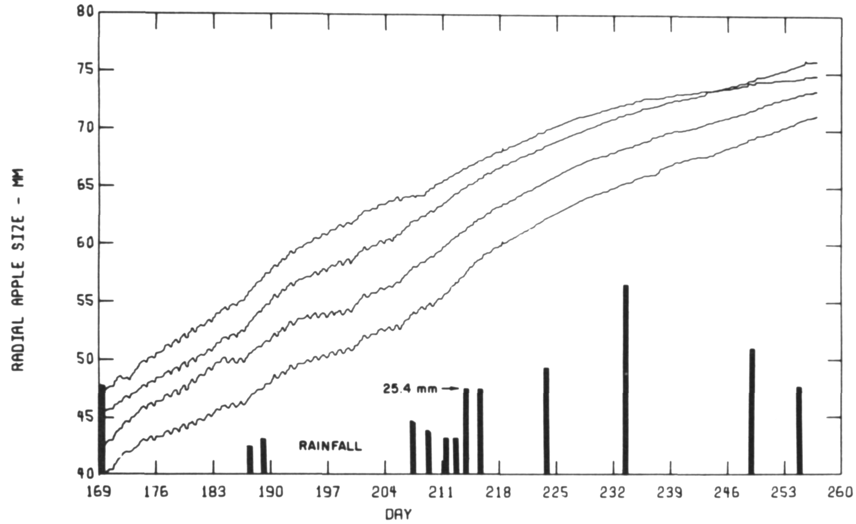

Fig. 3. Records of apple fruit diameter: the lower 2 curves are for fruit that received crop cooling irrigations on days 177 through 182 and on 5 scattered days between days 192 and 201; since the low-rate irrigations were infrequent, soil water conditions were essential the same for both the non-irrigated and irrigation-cooled plots.

Table 1. Field calibrations of electronic micrometers when installed on June 18, 1971 and when removed from the apples on Sept. 15, 1971, and a comparison of accumulated growth measured with the electronic micrometer and manual micrometer for each apple. Sensors 3 and 4 were each on an irrigation-cooled apple.

Measurement	Sensor 1	2	3	4
LVDT calibration (mm/mv)				
Installed	.252	.253	.252	.251
Removed	.231	.241	.239	.241
% Change	-8.3	-4.7	-5.2	-4.0
Apple size increases (mm)				
Electronic micrometer	29.9	26.8	30.8	30.5
Manual measurement	29.4	25.1	31.9	34.7
% Difference	+1.7	+6.8	-3.4	-12.1

the electronic micrometers and the oscillator-demodulators through which they operated. There was a slight loss of sensitivity, but all changes were less than 10%.

The total increases in apple diameters measured with the electronic micrometers and those determined from manual measurements of the apple dimension at the beginning and end of the test (Table 1) differed no more than 12%.

The success of this one-season test indicates that reasonably accurate, season-long records of apple size changes can be obtained using the electronic micrometer and mounting procedure that have been described.

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A Simple Method for Controlled Introduction of Fresh Air into Experimental Cold Storage Rooms[1]

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Abstract. **An inexpensive method for accurate control and measurement of fresh air introduction into experimental storage rooms is described.**

Introduction of fresh air into cold storage rooms for perishable commodities is intended to avoid accumulation of volatiles that may adversely affect the quality of the stored produce. Although this is a common practice with some commodities, notably citrus fruit, little information has been available on the optimal rates for the introduction of fresh air.

For commercial precooling, cold storage and transport of citrus and other fruits, fresh air is introduced at rates ranging from 1 to 6 exchanges of room vol/hr based on empty room vol (H.F. Th. Meffert, The Sprenger Inst. Wageningen, Holland; V. Gessel, TEMPCO, Alhambra, California and S. Biron, Citrus Marketing Board of Israel, Tel Aviv, personal communications). These rates equal approx 5 to 60 m^3/ton-hr of produce. The accumulation of CO_2 inside the room is often used as a criterion for determining the rate of fresh air introduction. Since ambient temp and relative humidity are rarely similar to those inside, introduction of fresh air at such high and possibly excessive rates may increase the refrigeration-heating load by a large factor. In addition, difficulties in maintaining the desired temp and relative humidity are likely to result. Thus, the environment inside storage rooms may be nonoptimal and cost of operation may be excessive.

When introduction of fresh air is used to avoid accumulation of undesired volatiles, determination of the min rates required would obviously be valuable. In small-scale experiments where fruit are placed in small containers, min rates required can be studied. However, data obtained in such experiments may not be directly applicable commercially, since factors, such as packaging, stacking and nonuniform air circulation, can not be evaluated in small scale experiments. Therefore, before min rates of fresh air introduction can be recommended to the industry,

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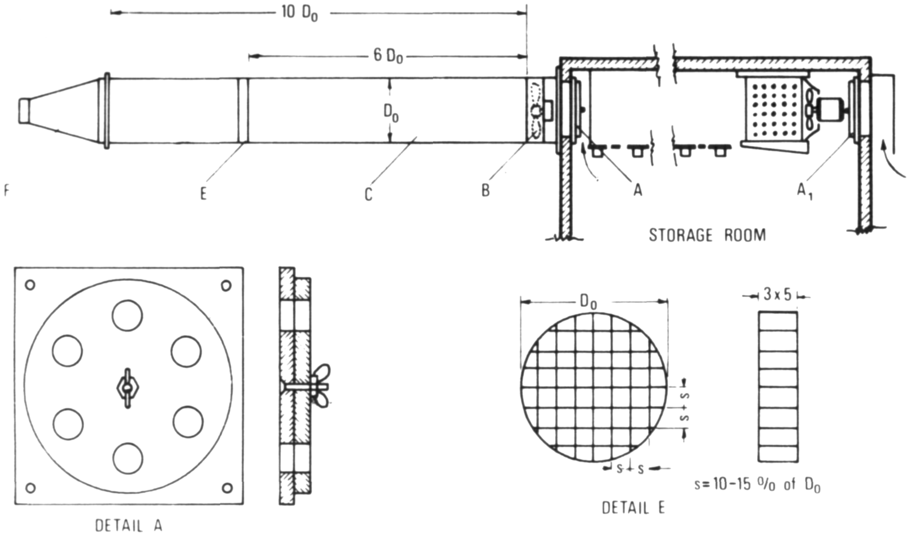

Fig. 1. **Diagram of system for controlled introduction of fresh air. The main design features are: A and A_1 = adjustable apertures; B = exhaust fan; C = measuring duct; D^o = diam of duct; E = air flow straightener; F = transformation piece; S = spaces between grids in straightener.**

larger-scale experiments should be performed in experimental storage rooms in which the packed commodity can be stacked in a pattern similar to that practiced in commercial storage or transport facilities.

This note describes a simple and inexpensive method for accurate control and measurement of rates of fresh air introduction into experimental cold storage facilities.

The method is based on positive suction of air from the room. The air withdrawing system contains 3 major parts (Fig. 1): A) an adjustable aperture which controls air flow; B) an exhaust fan; C) an exhaust duct at the end of which flow rates are measured.

The adjustable aperture is covered by 2 plywood discs each with 6 equal holes (Fig. 1, detail A). One disc can be rotated over the other. The degree of overlapping of the holes determines the amount of air flow. The relationship between the angle at which the disc is rotated and the free area created by the superimposed holes is a trigonometric function. Control over total air passage area can easily be achieved in small increments by manually rotating one disc. Fresh air is introduced into the room through an opening in the wall located behind the refrigeration coil. This hole is covered by similar discs (A_1) which serves only to seal the opening when no fresh air is needed. In determining the capacity of the exhaust fan (B), it should be remembered that the discs create a certain static pressure even when the air passage area is max. Therefore, fan capacity should substantially exceed the max capacity which may be actually needed. Proper design of the exhaust duct (C) is necessary for accurate measurements of air flow. The principles of its design, which are shown in Fig. 1, comply with the N.A.F.M. standards (1).

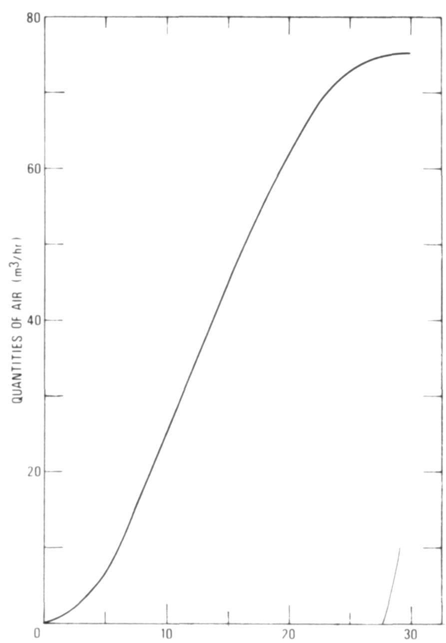

Fig. 2. **Relationship between angle of rotation of the disc and quantities of air passing through the air withdrawing system.**

The above described system has been in operation in 6 experimental cold storage rooms having a net vol of 10.8 m^3 each. Fan capacity was 900 m^3/hr, diam of duct was 20 cm, and diam of holes in the rotating discs was 3.5 cm. The exhaust duct was made of galvanized sheet metal. Air velocity was measured at the end of the transformation piece (Fig. 1; F) by means of an anemometer (No. 1400 Wilh. Lambrecht KG, Gottingen, W. Germany). With this system, fresh air has been accurately introduced into the rooms at rates ranging from 0 - 79 m^3/hr (Fig. 2). In an earlier design where a sliding door replaced the discs, accurate control of flow rates could not be achieved.

The described method may be used in research aimed at determining optimal rates of fresh air introduction which would be recommended to the industry and for other storage experiments with perishables, that require controlled fresh air introduction during storage or transport. The method itself however, is not intended for commercial application, since industry does not require the high controllability and accuracy the system provides.

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