An energy-saving air cooler

In modern telephone exchanges, the electronic equipment is sometimes even more sensitive than the employees to Australia's summer heat. Telecom's exchange at Balranald, in the hot dry south-west of New South Wales, has given problems in the past with trunk lines dropping out during conversations. A new type of air-conditioning system was installed there last year to prevent over-heating.

A similar system was installed at the Caulfield exchange in Melbourne. The performance of both was closely monitored last summer as part of the testing program for the new conditioners, which were developed by the CSIRO Division of Mechanical Engineering. Hydro

Thermal Engineering Pty Ltd, Adelaide, has recently begun manufacturing them under licence from CSIRO.

One of the main advantages of the new conditioners is their low energy consumption. Mr Don Pescod, leader of the team that developed the devices, has calculated that they use between one-ninth and one-fifth of the electrical energy consumed by conventional refrigerated conditioners doing a similar cooling job.

Electricity consumption figures for South Australia illustrate the importance of such savings. The use of air-conditioning has grown to such an extent that peak demand for power in that State now occurs in summer rather than in the traditional high-demand season, winter.

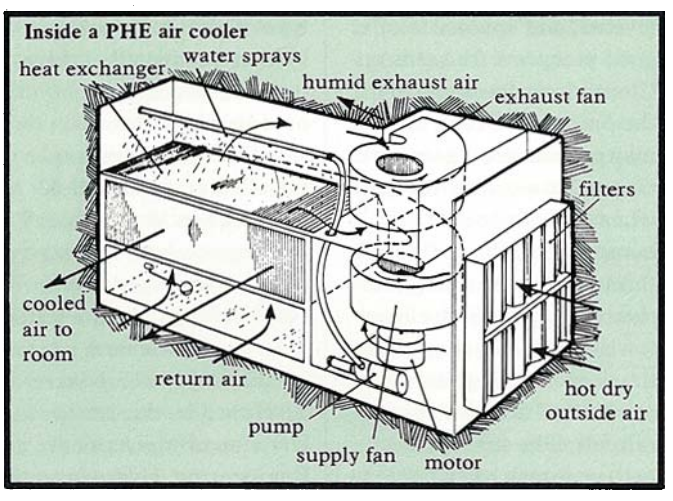
Another advantage is that the conditioners provide a continuous supply of fresh air; there is no recirculation. This makes them suitable for use in buildings such as hospitals, where clean air is essential.

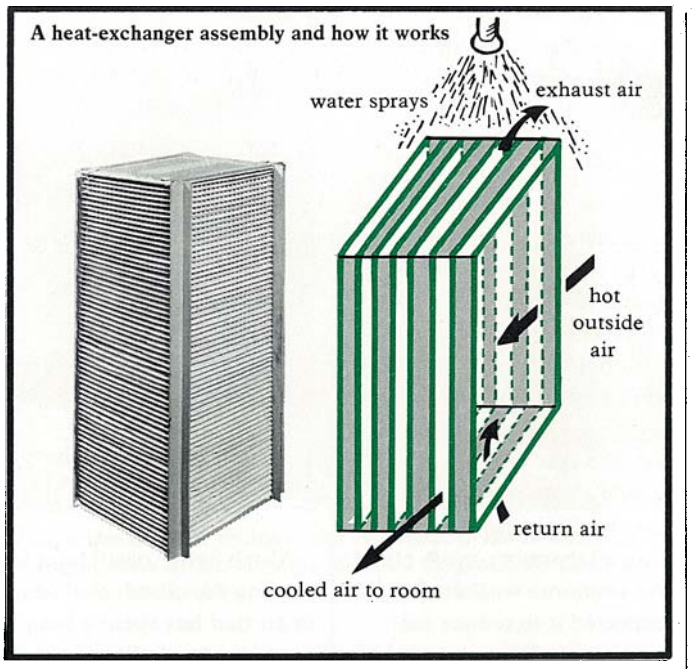
With the new conditioners, air cooling results from the absorption of heat by water as it evaporates. As they release the resulting water vapour outside the room or building being cooled, they do not produce an increase in humidity inside. This gives the conditioners a distinct advantage over evaporative air coolers in which water is evaporated by the incoming air-stream.

The method used to pass heat from the air being cooled to the water is described as the plate heat-exchanger (PHE) system. Thin vertical sheets of plastic (the plates) are sprayed with water on one side. Warm air entering the building passes along the other side, and the plates 'exchange' heat from the air to the water. Out-going air passes along the moist side of the plates, taking the water vapour with it.

The number of plates in a PHE assembly naturally varies with the size of the conditioner, but may range from about 150 to 500. The plates are usually square, with a breadth ranging from 300 to 600 mm. Small plastic projections on the plates keep them about 3 mm apart and stimulate turbulence in the air moving past. This increases the effectiveness of the device.

Each plate is joined to one of its neighbours at the top and bottom and to its other neighbour at each end. The result is a series of vertical and horizontal passages through the heat-exchanger assembly. Water sprays above the assembly keep the vertical passages wet. A fan blows outside air into the room through the horizontal passages and another, the exhaust fan, draws air out through the vertical passages.





In the diagram, the coloured outlines represent heat-exchanger plates and the grey areas joins between them. Water sprays keep one side of each plate moist. Incoming air is cooled as it passes along the dry side. Outgoing air passes along the moist side, taking evaporated water with it.

The fans, and a pump that returns unevaporated water to the sprinklers, are the only moving parts in the device. This should keep servicing requirements to a minimum. The simplicity of the units should also keep their price below that of refrigerated coolers.

The PHE units can be used to reduce room-heating requirements in cold weather as well as to provide cooling in summer. No water is required for this operation. The heat exchanger takes heat from the exhaust air and transfers it to the incoming air.

Tests at the Division show that the exchanger has an efficiency of about 85% when the unit is operating as a cooler and 70–75% when it is reducing heat loss in winter. Ways to produce units with even higher efficiencies are being considered.

PHE air-conditioners should be capable of giving satisfactory cooling in all areas of Australia except the humid tropics.

The quality of the water used does not have to be high, so long as sufficient flow is maintained to avoid build-up of residue. Bore water with a salts content of 3000 parts per million has been used in tests without problems.

The Hydro Thermal company is building units in two sizes initially. The first, about the size of those installed in the Telecom exchanges, is big enough to cool whole houses or small office complexes or factories. It takes in 1·5 cu m of air per second. The second is a smaller model for domestic use with a capacity of 0·5 cu m per s. The company is planning later to build both smaller and larger units.

Energy savings and performance limitations with evaporative cooling in Australia. D. Pescod. *CSIRO Division of Mechanical Engineering Technical Report* No. TR 5, 1976.