An illustration of semi-passive bioclimatic Architecture: The Belgian Pavilion Project for the Seville World Fair 1992

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ABSTRACT

In the national competition for the conception of a belgian pavilion for the Seville World Fair 1992, our bureau has presented an original project. The main features of our conception were:
- a building wrapped in an energetic glazed curtain façade, open to natural lighting, designed as to give a passive shading to the premises combined with a semi-passive cooling system.
- a building extremely economical in investment as well as running costs.
All the architectural design has been driven by the concern of avoiding solar gains through the apertures needed for the natural lighting of the floors. The whole building shade itself protects from direct solar radiation an open forum running at basement level.
On this bioclimatic passive conception, we have conceived the opportunity to act on the ventilation flows with a belgian patented evaporative system known as AMAZONE, a direct contact air/water exchanger in which water is vaporized while flowing on a vertical fiber bundle crossflow to air. The latent heat of vaporization is taken from the air which is cooled byabout 5 kelvin with a relative humidity gain of about 20%.
Compared with a classical thermodynamic air conditioning system, our proposal was able to reach an appropriate comfort level with much less investment as well as running costs.

S. Alvarez et al. (eds.), Architecture and Urban Space, 589–594.

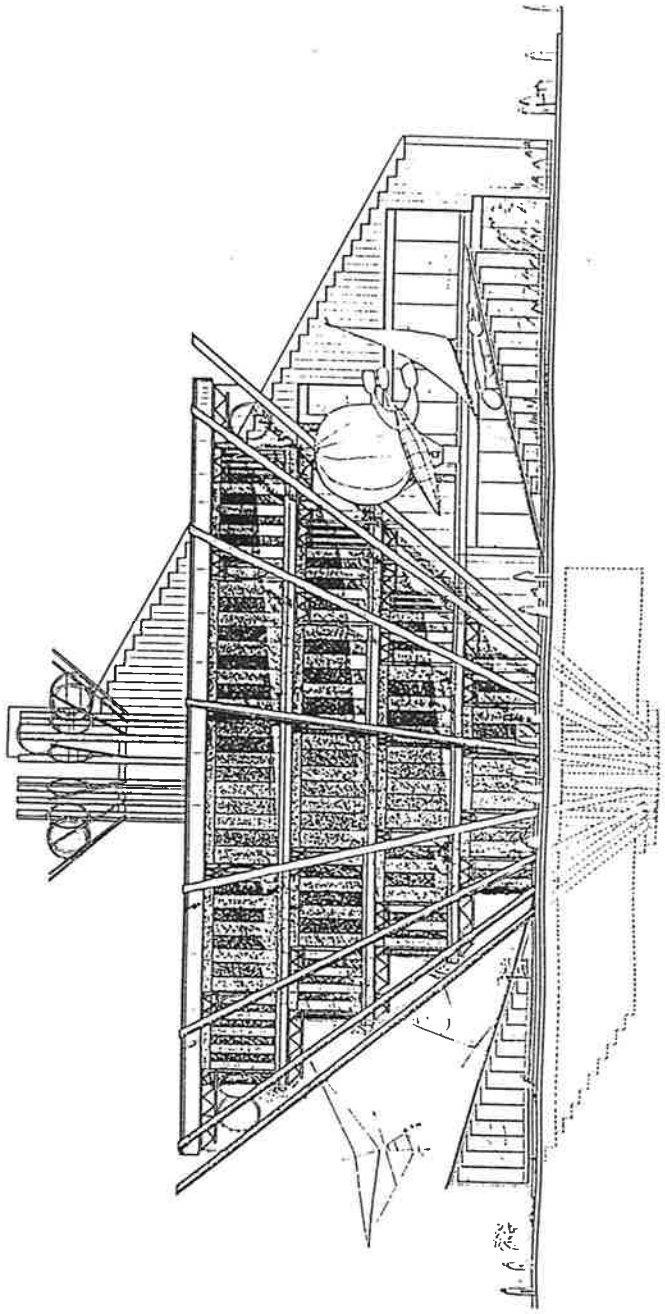

fig.1 General Sketch of the Belgian Pavilion

I Introduction

The building itself (fig.1) is caracterized by an uptodate architecture integrating the more recent experience in bioclimatics :

The project consists of a gigantic metallic top-like tree in a quarter grove of which is set a triangular based pyramid. The later acts as a stabilizing root to the top volume. Oriented south and covered with an opaque roof, it gives the necessary shade to the south part of the building.
In the top-like volume, each floor overhangs the lower glazed façade avoiding any direct solar gain. These façades are provided with openings for forced ventilation of the adjacent floors. Their repartition has been designed as to avoid any distributing air duct system while assuring a good equalized air flow everywhere.

II The Semi-Passive Cooling

Taking advantage of this well designed ventilation system, we have concieved the opportunity to act on the air flow with a belgian patented évaporative appliance known as the
"AMAZONE".
The Amazone is a direct contact gas/liquid exchanger (fig.2). The liquid phase (water in our case) flows downwards on a vertical synthetic fibers bundle streched between floor ans ceiling in front of the openings of the glazed façade. The gas, air in this case, is sucked through these openings by the general ventilation system and flows partly crossflow, partly counter currentwise through the bundle (fig.3). It vaporizes water and gains humidity on an adiabatic or subadiabatic way. The latent heat of vaporization is taken from the air which is cooled.
The installation has been computed as to get a 5 kelvin cooling effect with a relative humidity gain of about 20%.
The Amazone exchangers are modular and removable.

III Complimentary Active Cooling

The water needed for the wetting of the fibers bundles is stored in an underground 600 m3 reservoir, pumped through a pipîng network to every part of the building and flows back to the reservoir. Night running of the system, when wet thermometer temperature falls down to 17°C, provides the necessary cooling of this water volume. As a security back up to the normal cooling load, this is also helped by a water to water

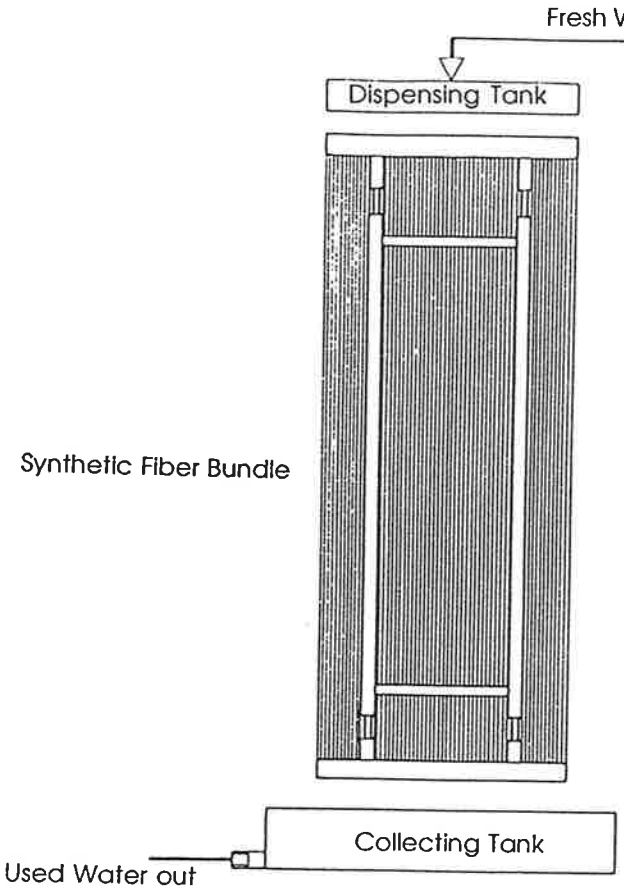

fig 2. Front View of the Amazone

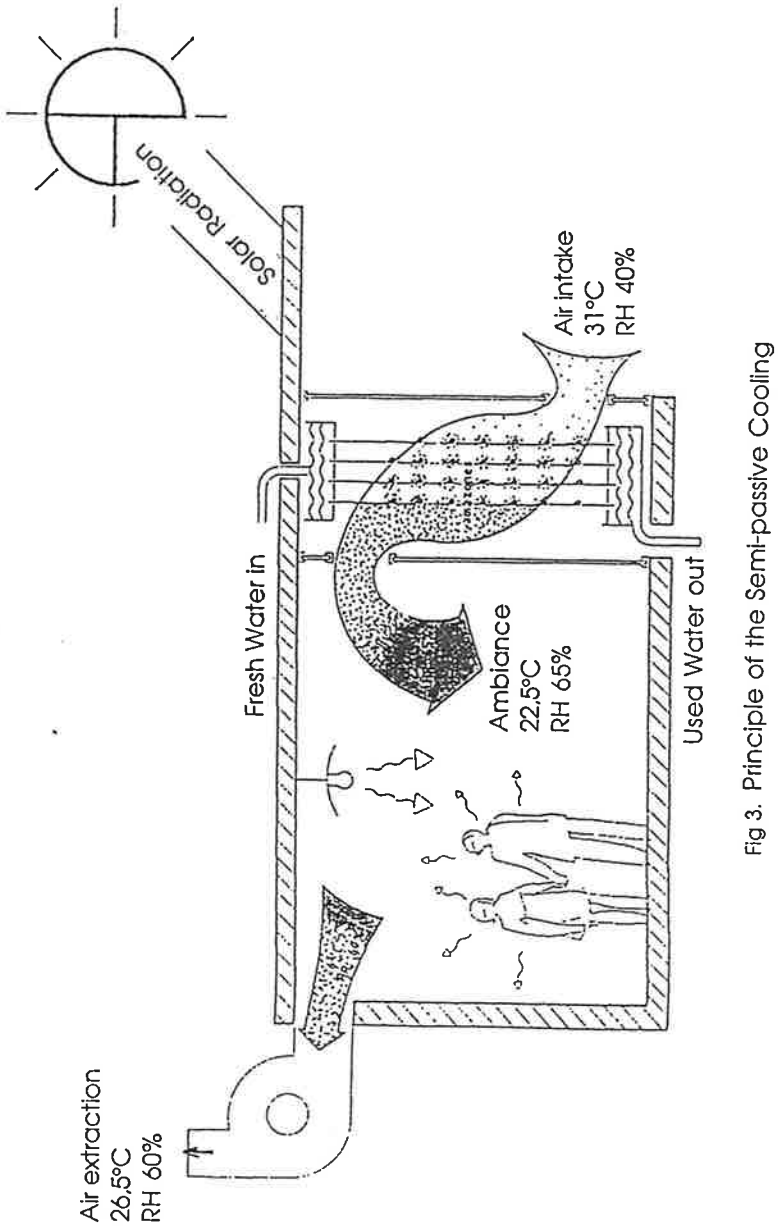

Fig 3. Principle of the Semi-passive Cooling

domestic hot water needed by the kitchen and the sanitary appliances of the building.

IV Discussion

The high volume flow of air (20 vol/h) will provide a steady breeze in the premises and an increased comfort feeling to the inoccupants by evaporative cooling of their own perspiration.
Compared to classical thermodynamic air conditioning system, our proposal is able to reach an appropriate comfort level with much less investment and running costs.

V Conclusion

The project assembled a lot of up-to-date and highly desirable features: **Passive and Low Energy Architecture** combined in an elegant , economical and comfortable building. In spite of these qualities, it was not the winner of the comptétition and will not be built.