Mirror Duct System to Use Natural Light

Benefits of the Mirror-duct System

Transmission of the natural light to any area
There are two ways in which the light duct can introduce natural light into the building. One is with the horizontal type, where light is captured at the exterior wall. The other is with the vertical type, where light is admitted on the roof and rooftop. Where the building has depth with areas difficult for light to access to, the vertical type is ideal. For windowless spaces where natural light cannot access to, such as the building core of a communal housing incorporating the bathroom, WC, kitchen, etc., conditioned by a building configuration of greater depth to frontage, the vertical type light-ducting system can serve to brighten with natural light.

The effect of energy conservation
The Mirror-duct System, after installation, requires no energy to run or maintain it. It will continue to bring in natural light in its lifetime of service, enabling a considerable energy consumption saving. In an actual case of an office building, the saving in power consumption for lighting was calculated at 1/3 of an ordinary consumption. In addition to this, the CO2 discharge from the lower lighting power consumption will be reduced drastically.

Comfortable and healthful light
Natural light, it goes without saying, is part of the natural world, supplying a balanced mix of nutrients that life-forms depend on. It also provides healthful portions of ultra-violet rays that serve to sanitize.

Basic Concept or Summary

Mechanism of the Mirror-duct System
The Mirror-duct System is composed of 3 unit-the light-capturing unit, light-transmitting unit, and the illuminating unit. Each unit has special features, as illustrated below.

- **Light-capturing unit**: It is integrated in the exterior wall and is able to admit natural light efficiently. In order to capture the sunbeam efficiently, a main mirror is installed in the plenum of the eave to reflect the beam inward. The configuration that must be adopted for the system to achieve the highest light-admitting efficiency will be based on year-long observation of the latitude, climatic conditions, azimuth, surrounding conditions, etc., of the region where the subject building may happen to be located.

- **Light-transmitting unit**: This unit transmits the captured natural light without losing its intensity. It is a "duct" that incorporates a high-reflectivity aluminum mirror on its inner surface. By transmitting the natural light into the building interior (the illuminating unit) uniformly and without loss of consistency in quality, a uniform distribution of illumination is obtained throughout the building interior.

- **Illuminating unit**: It illuminates the building interior with the transmitted natural light. At the same time that it emits the natural light efficiently, it rectifies any disparity and fluctuation in the beam by means of secondary mirror and light-scattering reflective panels. For example, near the light-capturing unit, where the intensity is greater, the illumination level will be lowered, but as the beam travels further inward, the illumination level will be increased to attain a uniform distribution of illumination intensity. Furthermore, it enables uniformity in illumination in the interior to be maintained by having illumination levels constantly checked with brightness sensors and augmented with a dimmer/mixer of artificial light.
**Office Building**

Mirror Duct System Reduces Your Annual Power Consumption by Approx. 65%

- Annual reduction in power consumption: A combination of the mirror duct and the light control system is expected to achieve an approx. 65% reduction in power consumption for office space lighting compared with the conventional system.

**Apartment House**

The Mirror Duct System introduces natural light to provide sufficient lightness to windowless bathrooms, washrooms and toilets.

A sufficient level of illumination is ensured with natural light only.

- In clear weather, illumination on the horizontal plane in each room (bathroom, washroom and toilet) reaches as high as 100 lx, thus ensuring a sufficient level of illumination with natural light only.

**Major awards received:**

- Association of Building Engineering and Equipment - The 1st Environment and Equipment Design Award
- Equipment and System Design Section I - Most Excellent Award
- Japan Aluminium Association - Technology Award
- Illuminating Engineering Society of North America - IES Illumination Awards - Award of Excellence
- The Illuminating Engineering Institute of Japan - Japan Lighting Award

**Installation in Practice or Schedule**

**Domestic**

- Strategic Planning and Management Office at Japan Aerospace Exploration Agency
  (Completed in 2003 at Tsukuba city, Ibaragi)

- Toyota Motor Corporation, Headquarter office
  (Completed in 2005, Toyoda city, Aichi)

- Underground canteen for employees

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