Radiant Heating

How it works and when to use it.

When all is said and done, most houses need auxiliary heating. The ideal system will match the load of the house and the lifestyle of the occupants. It should be inexpensive to purchase, maintain, and operate. Many choices are familiar. A relative newcomer to the field is electric radiant heating. For many people, radiant heating conjures up images of infrared lamps over french fries—not altogether wrong.

Radiant heating works on the principle that by heating the surfaces that surround us, we can reduce the air temperature and still maintain the same level of comfort. The high radiant temperature compensates for the lower air temperature. To achieve this, the radiant system must elevate large surface areas to above the air temperature.

Comfort

To me, thermal comfort means lying on the beach on a sunny day with a light sea breeze. Others detest this activity. The same subjectivity is true of thermal comfort in general, which is why engineers must rely on the responses of large numbers of people in order to quantify the human *comfort zone*. The elusive condition called comfort is determined by a host of factors including air temperature, mean radiant temperature, air velocity, humidity, activity level, and clothing level.

Except when we are sweating profusely (evaporative cooling), the major heat exchanges between us and the environment are convective and radiant. Air temperature and air movement determine the convective exchange. The radiant exchange is determined by the temperatures of all the surrounding surfaces, each weighted according to its emmisivity and its angle of exposure to the subject (see Figure 1). The weighted average of these temperatures is the mean radiant temperature (MRT).

With relatively still air, the air temperature and MRT can be averaged to determine the *apparent temperature*—what we feel. This would suggest that each degree rise in the MRT allows a one-degree drop in air temperature without affecting comfort. While the actual mathematical relationship is more complex, the important point is that chilled walls keep you cool in otherwise uncomfortably hot air and vice versa. Similarly, on a cool spring day you feel cold in the shade, warm in the sun.

Radiant strategies

If radiant heating is the goal, large areas at relatively low temperatures are preferable to small concentrated heat sources. This will result in evenness, rather than hot spots such as nearby to woodstoves. Mass is also helpful in a radiant surface, since the radiant effect depends on the surfaces staying warm, even after the thermostat no longer calls for heat. Otherwise, the occupants may jack up the thermostat between on-cycles to raise the air temperature. Whether the system is in the floor or the ceiling doesn't make much difference since one will rapidly heat the other before heating the air, which is transparent to radiant heat.

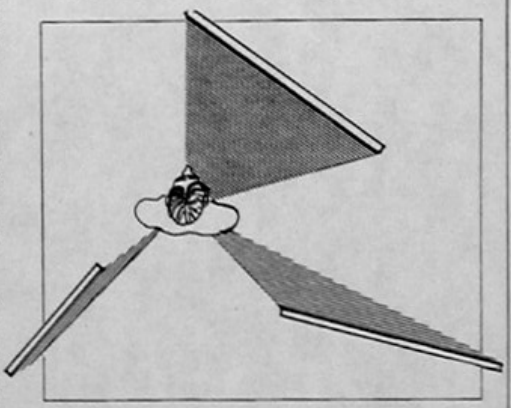

Figure 1. The radiant effect of a hot surface corresponds to the angle it forms with a subject. Large surfaces facing and close to the subject have the greatest effect.

There are many relatively low-cost systems for circulating hot air or water through a floor (Solar Age 5/82, 1/83). Also on the market are a number of electric radiant systems. These come in great variety (see list at end of article). Some install under the drywall, others are embedded in plaster, and still others are finished panels made to mount on the ceiling or lie in a

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