ZOMEWORKS
CORPORATION
ZOMEWORKS Mfg., Inc. COOL CELL, Inc.

COOL CELL™ ARCHITECTURAL CLIMATE-CONTROL*

Background

The **Cool Cell™ architectural climate-control system** has grown out of 31 years of innovation in design and manufacture of passive energy products. Earlier versions of the Cool Cell™ system used custom-molded polyethylene bottles, five-gallon water bags, and even two-liter soda pop bottles.

Since 1969, Zomeworks has specialized in the development of products that operate passively, conserve energy, and require no power. Zomeworks' customers range from homeowners and ranchers to telecommunications companies and utilities.

Three product lines have resulted from working with the sun, the natural properties of water, and the movement of heat:

1 **Mounting systems for solar panels**, including Zomeworks' patented Track Rack™, which tracks the sun through the day with no power and no moving parts, for maximum power output from its solar panels. Zomeworks' Track Rack™ is still the undisputed cadillac of the tracker industry.

2 **Architectural products**, including Sunbender® reflector shades, Skylid® self-operating louvers, and Zomeworks' latest innovation, the Cool Cell™ architectural climate-control system, which is simple to install and costs almost nothing to operate.

3 **Cool Cell™ temperature-regulating cabinets**, for stand-by batteries and instrumentation. Development of the Cool Cell™ cabinet provided much of the foundation for Cool Cell™ architectural climate-control systems.

The 'Zome' name is derived from a combination of 'zonohedron', a technical term from geometry, and 'dome/home'. Zome System geometry kits now seen in toy stores incorporate geometry discovered and patented at Zomeworks 30 years ago. Playground climbers based on this geometry can be seen in Albuquerque-area parks. The Zome geometry kits are available from Zometool Incorporated of Denver, CO.

Please call Jesse Rodefer, architectural Cool Cell division, at 505 242 5354, ext 232, for further information.

***Patent Pending**

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WORK LEADING UP TO THE ARCHITECTURAL COOL CELL

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We first thought to both heat and cool buildings using the same collector on south facing walls. Years ago Shawn Buckley experimented with passive heaters where collector and inside tank were at the same level, he used a layer of oil on top of water to make a very sensitive fluidic check valve. Buckley advised us that it would be easier to use floating plastic check valves. We had made these years earlier and then benefited from the ingenious discovery of Michael Zeiler that a valve seat as good or better than one made by a lathe can be formed by simply hammering a ball bearing of the same size as the float ball into the open end of a copper pipe.

Joe Minella named these valves boogie valves because the plastic balls could be seen through the clear pipe to Boogie when open. The valves can be tuned to great sensitivity by pushing copper wire weights into pre drilled holes.

Aaron Shiver did the set up and experiments on these Di thermal walls using a stack of reject 6 string Cool Cell™ lids that George Sousea welded and which were rejected for some reason. (We never found any of them to leak.) They were 18 square feet and very heavy. Aaron was going to UNM studying Mechanical engineering. I hired him over several other candidates when I found he worked part time in a tire shop fixing tires. He was able to wrestle these enormous heavy 6 string lids wherever they needed to go.

See figure 1, side view of tank, plenum, valve and connecting hoses.

This scheme worked both for heating and cooling. The valves all leaked but, very slowly and not enough to effect the performance. One time, inexplicably, a check valve did not seat properly and lost all the heat that it had gained in the day during the night. See figures 2 and 3. This very rare event made me nervous and also the complication of reversing the valves from winter heat gain to summer heat loss promised to make the valves expensive. I decided I wanted ceiling tanks.

Bill Mingenbach suggested using 8" PVC pipes as overhead tanks and we found they worked well. We switched to this with roof top radiators rather than wall radiators in August of 1999. You can see in our tests or by reading L. Newbauer's work, such as *Diurnal Radient Exchange with the Sky Dome* by Richard D. Cramer and L.W. Newbauer Volume 9 #1 *Solar Energy Journal 1964,* that while walls radiate well and drop considerably below ambient, roofs are a lot better. We continue to experiment with wall mounted collectors. They receive more radiation at our (34° N) latitude during the coldest months than even 26° sloped roofs and one needs no pump or electricity to operate them. Of course this is nothing new. Harold Hay has made completely passive heating and cooling schemes for decades but our methods were slightly different with some advantages (and disadvantages).

Notice in Figure 2 that the plenum temperatures stay at 32° even though ambient and parallel plate temperatures drop far below freezing. It must be that ice was forming in the plenum, releasing the huge heat of fusion.

TEMPERATURES OF HEATED VS UNHEATED PLATES

October 2002

Bristol Stickney and I did many tests with 11" x 11" 9.5 watt electric heating pads placed behind 12" x 12" 1/8" aluminum plates. We always tested identical twin plates, one with power and the other not. We started with black plates but later painted them white to reduce temperature rise in the sun. These 12" x 12" plates had 32.4 BTU's per hour to get rid of. Of course they grew warmer than a twin, faced the same way with no power. During the night a heated side typically ran 20° warmer than an unheated side. From this I calculate that a typical U valve for a wall at night is
32.4/20°F BTU per hour = 1.6 BTU/°F per hour per square foot.

The same heat to a horizontal surface usually raises the temperature only about 15° giving a U value of 32.4 BTU per hour /15°F = 2.16 BTU/°F per square foot per hour.

Some of our graphs show windy times when the heated twin comes closer to the unheated as wind sweeps heat away.

A great surprise is to find that during clear dry nights the heated horizontal plate temperature does not rise as high as ambient air temperature. Night radiation to the sky can excede 9.5 watts per square foot.

The experiments with the 9.5 watt per square foot panels where we deduce U values of 1.6 and 2.16 might lead you to expect a 1000 watt per M^2, sun, 93 watts per square foot, to raise temperature = .9 x 93 x 3.413/2.16 = 132°F above ambient but I have never seen such a large temperature rise with black point. Heat flows more readily as the flux increases, and also as temperatures rise. We should test the same panels with 100-watt heaters to show that the Δt is never 10 times that of the 10-watt panel but always less.

We are making a set of 100 watt, 10 watt, no watt 12" x 12" plates for the meeting.