

EARTHSHIPS

THERE IS A FAMOUS AMERICAN ARCHITECT CALLED MICHAEL REYNOLDS. HE HAS A VERY LOW OPINION OF CONVENTIONAL HOUSING WHICH HE CONSIDERS TO BE A “COMPARTMENT” WHICH IS WHOLLY DEPENDENT ON OUTSIDE POWER SOURCES. HIS OPINION IS JUSTIFIED. HE PRODUCES BUILDINGS WHICH HAVE BEEN NAMED “EARTHSHIPS” BY HIS WIFE AND THAT NAME HAS CAUGHT ON WORLDWIDE.

THE OBJECTIVE IS TO MAKE A HOME WHICH HAS NO UTILITY BILLS AT ALL. A BUILDING WHICH COLLECTS ITS OWN WATER AND USES THAT WATER SEVERAL TIMES. GENERATES ITS OWN ELECTRICAL POWER. PROVIDES ITS OWN HEATING AND COOLING. GROWS SOME OF ITS OWN FOOD, AND USES MATERIALS MANY OF WHICH HAVE BEEN DISPOSED OF BY PREVIOUS OWNERS – VEHICLE TYRES, ALUMINIUM DRINK CANS AND GLASS BOTTLES. AN “EARTHSHIP” CAN BE A STYLISH AND COMFORTABLE HOME :



ALTHOUGH, OBVIOUSLY, THE OVERALL COST OF THE STRUCTURE AND FURNISHINGS DEPENDS ON THE QUALITY CHOSEN BY THE OWNER, THIS PARTICULAR EARTHSHIP IS ONE SHOWN IN THE FILM “BUILDING OFF THE GRID” WHICH CAN BE FOUND ON THE PEER-TO-PEER NETWORK. IT TOOK FIFTY VOLUNTEERS FOUR WEEKS TO COMPLETE THE BASIC STRUCTURE AND THEN ANOTHER TEAM OF WORKERS WHO WERE PAID TO SUPPLY AND INSTALL THE FITTINGS AND FIXTURES.

THE STRUCTURE FACES SOUTH AND HAS TWELVE LARGE SOLAR PANELS MOUNTED ALONG THE TOP OF THE GREENHOUSE AREA. ALTHOUGH THIS PICTURE DOES NOT SHOW IT, THERE IS A DRAINAGE DITCH ALONG THE BACK OF THE PROPERTY TO DIVERT HEAVY RAINWATER COMING OFF THE PROTECTING HILLSIDE BEHIND THE PROPERTY. NOTICE THE TWO VENTILATORS ON TOP OF THE GREENHOUSE.



THE WALLS OF THE PROPERTY ARE SEVEN FEET (2.13 METRES) THICK. THIS IS TO ALLOW THE USE OF FAIRLY SIMPLE MATERIALS AND MORE IMPORTANTLY, TO PROVIDE THERMAL MASS WHICH KEEPS THE INSIDE OF THE BUILDING WARM IN WINTER AND COOL IN SUMMER. THERE ARE NO SIGNIFICANT BILLS FOR HEATING OR COOLING AND NORMAL ELECTRICAL EQUIPMENT IS RUN FROM THE POWER PROVIDED BY THE SOLAR PANELS, A BANK BATTERIES AND A MAINS INVERTER.

THE DESIGN OF THE ELECTRICAL SYSTEM IS OLD-FASHIONED USING SOLAR PANELS TO CHARGE LEAD-ACID BATTERIES. INITIALLY, DURING CONSTRUCTION, THREE OF THE SOLAR PANELS WERE USED AND JUST PROPPED UP TO FACE THE SUN TO POWER A BATTERY BOX WITH A MAINS INVERTER :





THE OVERALL DESIGN IS SET UP FOR CONSTRUCTION BY UNSKILLED WORKERS UNDER THE SUPERVISION OF A FEW EXPERIENCED PEOPLE, BUT LET ME POINT OUT THAT THIS IS A CIVIL ENGINEERING PROJECT AND SO A REASONABLE LEVEL OF UNDERSTANDING IS NEEDED BEFORE YOU BUILD ONE FOR YOURSELF.

FOR EXAMPLE, THE ROOF SPANS ACROSS THE GAP BETWEEN THE OUTSIDE WALLS. THE LOADING ON ANY SUCH BEAM INCREASES WITH **THE CUBE** OF THE DISTANCE BETWEEN THOSE WALLS. THAT MEANS THAT IF YOU WERE TO DOUBLE THE WIDTH OF A ROOM, THEN THE SUPPORT NEEDED TO HOLD THE ROOF UP, INCREASES BY A FACTOR OF **EIGHT TIMES**. THIS CAN, OF COURSE, BE ACHIEVED, BUT YOU REALLY NEED TO BE AWARE OF IT. IN THIS PARTICULAR BUILDING, THE ROOF IS HELD UP BY MANY TREE TRUNKS WHICH HAVE BEEN STRIPPED AND PREPARED FOR THE JOB :



THESE BEAMS ARE VERY HEAVY AND ARE QUITE CAPABLE OF CAUSING SERIOUS INJURY IF NOT HANDLED CAREFULLY AND SENSIBLY. THEY FORM THE JOISTS WHICH SUPPORT THE ROOF AND AS THERE IS A GAP OF ONLY ONE FOOT BETWEEN THEM, MANY ARE NEEDED. THEY ARE ATTACHED TO THE TOP OF THE WALL BY STEEL RODS DRIVEN THROUGH THEM AND INTO THE TOP OF THE WALL.

THE MAIN CONSTRUCTION IS WITH VEHICLE TYRES AND ABOUT A THOUSAND ARE NEEDED FOR THE BUILDING. EACH TYRE IS FILLED WITH COMPACTED EARTH AND THEN THEY ARE STACKED IN A STAGGERED BANK AND GROUTED IN PLACE USING MOTAR. JUST TO CLARIFY :

- 1. CEMENT IS A GREY POWDER.**
- 2. MORTAR IS A MIXTURE OF CEMENT AND SAND WETTED WITH WATER AND WHICH SETS INTO A SOLID.**
- 3. CONCRETE IS MORTAR WHICH HAS PEBBLES MIXED INTO IT.**
- 4. REINFORCED CONCRETE IS CONCRETE WITH STEEL BARS IN IT.**

ALSO USED IN THESE CONSTRUCTIONS IS ADOBE WHICH IS MUD AND STRAW MIXED TOGETHER. PROPERLY MADE ADOBE DRIES INTO A SOLID BLOCK AND IS USED IN HOT, DRY COUNTRIES AS A MAIN BUILDING MATERIAL, BUT IT NEEDS TO BE WATERPROOFED AGAINST FUTURE RAIN.



THE TYRES ARE OVERLAPPED IN SUCCESSIVE ROWS, FORMING A STABLE STRUCTURE, AND THEN MORTAR GROUTING IS APPLIED BETWEEN THEM. THE OUTSIDE IS ENCLOSED IN AN EARTH BANK AND THE INSIDE IS SMOOTHED OVER.

THIS STYLE CAN BE SEEN AT THE BACK DOOR ALONGSIDE THE GREENHOUSE AREA :



THE CONSTRUCTIONAL DETAILS CAN BE FOUND IN THE BOOKS BY MICHAEL REYNOLDS "GARBAGE WARRIOR", "EARTHSHIP", "COMFORT IN ANY CLIMATE", ETC. OR FULL CONSTRUCTIONAL PLANS CAN BE BOUGHT DIRECT FROM MICHAEL.

WATER IS COLLECTED FROM THE ROOF, FILTERED AND THEN STORED IN MASSIVE PLASTIC TANKS WHICH HAVE A TOTAL CAPACITY OF 6000 US GALLONS (22,700 LITRES). THERE ARE NO PUMPS AS ALL WATER FLOWS UNDER GRAVITY. WATER USED FOR WASHING IS THEN USED FOR TOILETS AND THEN ON TO WATER THE PLANTS WHICH GROW AS FOOD.



THE POSITIONING OF THE TANKS IS IMPORTANT AS THEY HAVE TO BE JUST BELOW THE ROOF SO THAT RAINWATER FLOWS INTO THEM UNDER GRAVITY AND YET THEY HAVE TO BE HIGHER THAN SHOWER-HEADS FOR THE SAME REASON (UNLESS A PUMP IS USED FOR SHOWERS). A SIMPLE FILTER IS USED TO REMOVE ANY BLOWN MATERIAL WHICH FINDS ITS WAY INTO THE WATER INTAKE.

WHILE UNSKILLED PEOPLE CAN DO MOST OF THE WORK, THERE ARE A NUMBER OF TRADE SKILLS WHICH ARE NEEDED – PLUMBER FOR THE PIPING, ELECTRICIAN FOR THE ELECTRICS, ENGINEER FOR THE LEVELLING AND CONCRETE WORK, GLAZIER FOR THE DOUBLE GLAZING UNITS, ETC.



STEEL BARS CALLED “REBAR” ARE DRIVEN INTO THE WALLS AND POSITIONED TO THE EXACT HEIGHT AND THEN A REINFORCED CONCRETE RING IS CAST AROUND THE TOP OF THE WALLS TO GIVE OVERALL STRENGTH TO THE STRUCTURE BEFORE THE VERY HEAVY TREE TRUNKS ARE PLACED ON IT.

A NICE FEATURE OF THIS STYLE OF CONSTRUCTION IS USING COLOURED GLASS BOTTLES IN WALLS TO ALLOW LIGHT THROUGH THE WALL AND TO ALLOW ARTISTIC DESIGNS WHICH CAN GIVE THE IMPRESSION OF STAINED GLASS.



WHEN THE WALL IS FINISHED OFF AND THE BOTTLES POLISHED, THE EFFECT IS REALLY GOOD, ESPECIALLY SINCE THE GLASS BOTTLES ARE EFFECTIVELY FREE, BEING RECYCLED MATERIALS. HOWEVER, CHOOSING THEM AS PART OF YOUR LIVING ROOM IS A MATTER OF PERSONAL TASTE :



IT IS QUITE NORMAL TO HAVE CONVENTIONAL STYLES OF CONSTRUCTION :





THE IMPORTANT THING TO REMEMBER ABOUT THIS HOUSE IS THAT THE WALLS ARE THICK AND SO HAVE HIGH THERMAL MASS. THE 'GREENHOUSE' SECTION ALL ALONG THE SOUTH SIDE OF THE MAIN BUILDING FORMS A HEAT BUFFER AND WATER FILTRATION. THE ROOF IS SERIOUSLY EFFECTIVE AS IT IS A ONE-INCH THICK LAYER OF TIMBER WITH TARRED PAPER COVERING IT, AND THEN AN 8-INCH THICK LAYER OF POLYSTYRENE IS LAID ON TOP OF THAT, AND FINALLY A RIDGED METAL ROOF IS PLACED ON TOP AS THE EXTERNAL SURFACE. THAT IS A SERIOUSLY EFFECTIVE THERMAL LAYER.

THIS STYLE OF CONSTRUCTION IS CERTAINLY WORTH CONSIDERING AND WHILE I CERTAINLY APPROVE OF IT, IT CAN DEFINITELY BE IMPROVED. FOR EXAMPLE, THE EFFECTIVENESS OF THE 'GREENHOUSE' SECTION FOR GROWING FOOD COULD BE

FOUR TIMES GREATER IF SHAPED DIFFERENTLY. AS LES BROWN OF CANADA EXPLAINS, A PROPERLY PROPORTIONED PYRAMID HAS A MAJOR EFFECT ON GROWTH :



THIS IS THE PYRAMID WHICH LES USED. IT IS THIRTY FEET TALL AND FACES IN A NORTH—SOUTH DIRECTION AND SO WOULD MATCH PERFECTLY WITH AN EARTHSHIP. IN CANADA, IT PRODUCES SIX FULL CROPS PER YEAR AND THE COMPARISON BETWEEN PLANTS GROWN OUTSIDE (OR IN A CONVENTIONAL GREENHOUSE LIKE MICHAEL SHOWS) AND PLANTS GROWN INSIDE THE PYRAMID ARE :

TOMATOES: OUTSIDE; 12 TO 14 LBS PER PLANT, PYRAMID; 50 TO 60 LBS PER PLANT.

LETTUCE: OUTSIDE; NORMAL SIZE, PYRAMID; TWO TO THREE TIMES LARGER.

CABBAGE: OUTSIDE; 3 POUNDS, PYRAMID; 12 TO 13 POUNDS.

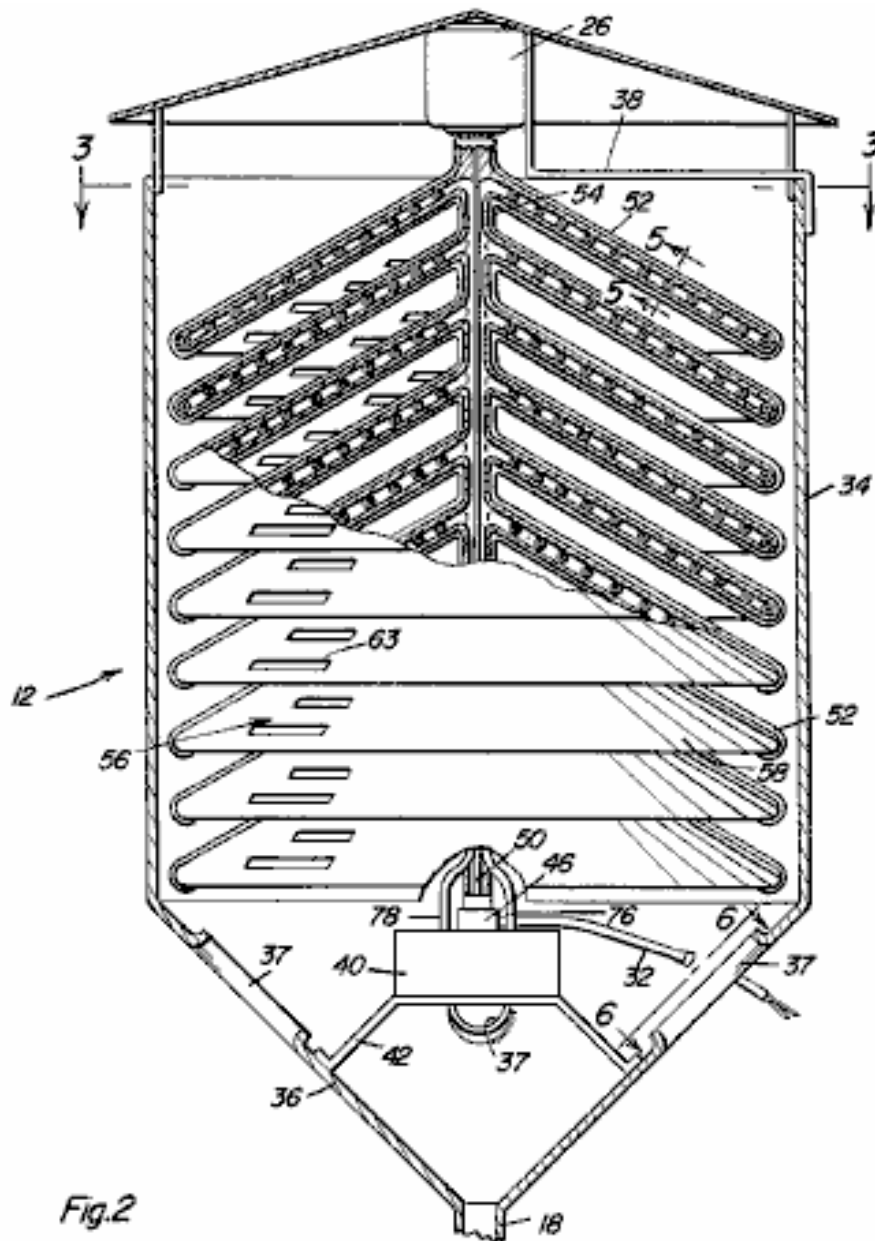
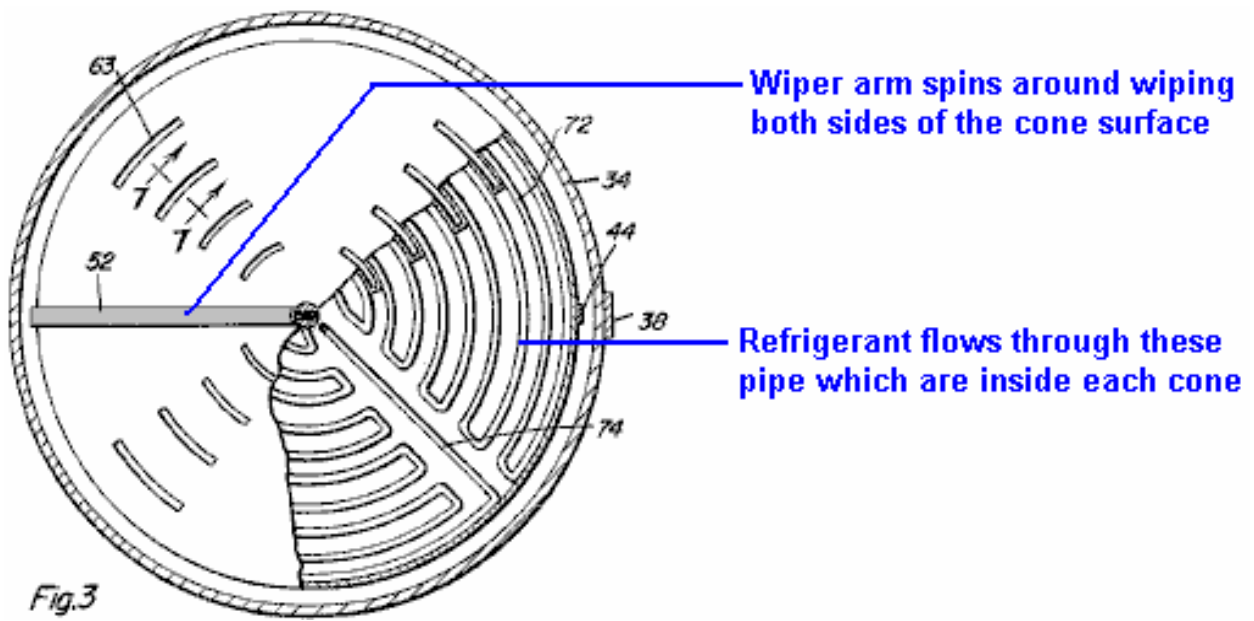
RADISHES: OUTSIDE; THE SIZE OF A QUARTER, PYRAMID; FOUR INCH DIAMETER.

CUCUMBERS: OUTSIDE; 1 POUND, PYRAMID; 4 POUNDS.

A PYRAMID ORGANISES ITS OWN WATERING, DESTROYS PESTS, PRESERVES FOOD, GIVES MUCH BETTER FLAVOUR TO EVERYTHING AND PRODUCES CONTINUOUSLY ALL YEAR ROUND (ALTHOUGH IN THE BITTER CANADIAN WINTERS, IT NEEDS TO BE HEATED, POSSIBLY WITH A WOOD-BURNING STOVE FOR YEAR-ROUND PRODUCTION).

THEN THERE ARE THOSE MASSIVE RAINWATER TANKS WHICH REALLY ARE NOT NECESSARY. AN EFFECTIVE ALTERNATIVE IS THE DESIGN OF ELMER GRIMES IN 1961. THIS DEVICE PRODUCES MAJOR AMOUNTS OF CLEAN WATER FROM AIR.

ESSENTIALLY, IT IS A REFRIGERATOR WHICH CHILLS A METAL CONE WHICH HAS A CAR STYLE WINDSCREEN WIPER ABOVE AND BELOW, TO KEEP PUSHING THE CONDENSED WATER OFF THE CONE. FOR EFFICIENCY, SEVERAL CONES ARE STACKED IN A VERTICAL POSITION. SEEN FROM THE TOP IT LOOKS LIKE THIS, WITH SLOTS IN THE CONES TO ALLOW THE FREE FLOW OF AIR THROUGH THE STACK :



THIS VERY EFFECTIVE WATER-MAKING SYSTEM COULD BE POWERED BY ONE OF THE MANY FREE-ENERGY DEVICES, SAY, THE CHAS CAMPBELL GENERATOR OR IT COULD BE POWERED BY THE EXPENSIVE SOLAR PANEL ARRAY ALREADY SUGGESTED BY MICHAEL. THE WATER OUTPUT IS SUFFICIENT TO SUPPLY A FARM IN TEXAS.

THEN WE HAVE ALL THOSE EXPENSIVE SOLAR PANELS. THE PROBLEM WITH THOSE (APART FROM THE COST OF BUYING THEM) IS THAT THEY CHARGE THE BATTERY BANK WITH CONVENTIONAL DC VOLTAGE AND SO THE BATTERIES WILL NEED REPLACING EVERY FOUR YEARS OR SO. ONE OF THOSE SOLAR PANELS WOULD EASILY POWER A GOOD MOTIONLESS BATTERY CHARGER CIRCUIT WHICH WOULD GIVE PULSED DC CHARGING AND KEEP THE BATTERY BANK UP TO SCRATCH INDEFINITELY. ALTERNATIVELY, A DONNIE WATTS GENERATOR WOULD PROVIDE ALL OF THE NECESSARY POWER WITHOUT NEEDING SOLAR PANELS OR BATTERIES.

SO, MY OPINION OF THE EARTHSHIP IS THAT IT IS GREAT, BUT IT COULD BE CHEAPER AND MUCH MORE EFFECTIVE.

THESE NOTES : <http://www.free-energy-info.com/Earthship.pdf>

VIDEO : <https://youtu.be/mT3d2zu1Tms>