RUN OF THE MILL

Summer 2010

The Ruskin Mill Educational Trust Magazine For:

Ruskin Mill College, Glasshouse College and Freeman College

Frank Chester: The Interview

to celebrate a world event at Freeman College

In tradition with the casting of bells at Ruskin Mill and Glasshouse Colleges, Freeman College was guided by Frank and his ground-breaking discoveries in the casting of their bell on June 11th 2010. An artist, sculptor and geometrician from San Francisco, Frank explains his work and connection with Ruskin Mill Educational Trust.

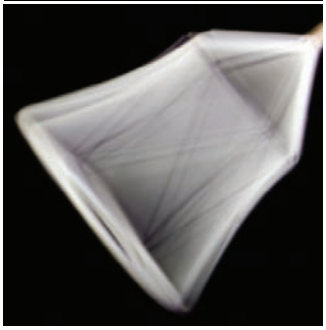
Frank with a model of the bell and hanging design. Right: A Chestahedron and, below, the bell form when spun

What is a Chestrahedran?

A Chestahedron is a seven-sided form, also known as a septahedron, resting between a Hexahedron and Octahedron. 'Septa' means seven and 'hedron' means faces. Its significance is that the Chestahedron has not be found before although there is evidence that ancient schools as far back as 2000 years ago were studying such forms. The seven-sided form was found artistically. It took three months of failures using scientific approaches before I returned to my artistic training for a solution. I realized then that the points of the form were not equidistant from the centre, whereas normally they are in platonic forms such as a hexahedron. I then took a ball of clay and went through a process of carving 7 cavities, removing exactly the same amount of clay from each hole until the curvature of the ball disappeared. It effectively had straight lines, and 42 triangles. The cavities were filled with plaster of paris and when, extracted and glued together, formed a crude Chestahedron.

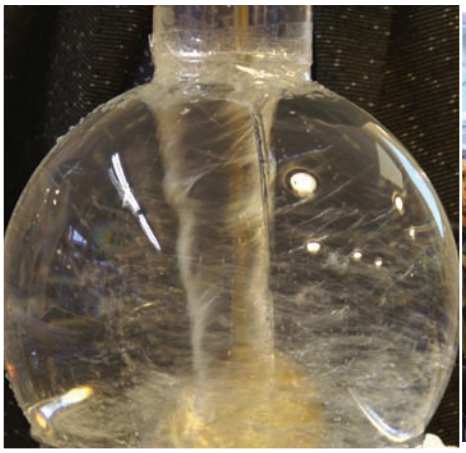
How did you discover the Chestahedron had a relationship to the bell form?

I have developed my artistic process based on alchemy, which combines the elements of earth, air, fire and water. The Chestahedron was found using the element of earth followed by a water process. The only way I could do this was to make the Chestahedron flow. When I turned or spun the Chestahedron, the form turned into a bell. This was a complete surprise as I was not looking for this at all. If you watch the Chestahedron being spun, you will see a bell form, which reveals the secret geometry of the bell. Until then, bells had been designed by trial and error.



How did you come to be involved with Ruskin Mill Educational Trust and Freeman College?

A lady who knows my work, Patricia Dickson, brought Aonghus Gordon (Founder and Director of the Trust) to my home in California and within an hour or so of his arrival, Aonghus bought two of my sculptures and asked about a bell for Freeman College. Aonghus was clearly inspired! My part of this project was to ensure they followed the geometry



Above: The vortex created by spinning a Chestahedron in water as demonstrated to staff at Freeman College in a recent lecture by Frank

properly. Secondly I wanted to make sure the bell isn't mounted from the top. There isn't a bell in history that hasn't been hung by its neck! I wanted the whole bell to vibrate and not have any dead spots, which you can't avoid if it is hung by the traditional method. So I designed a swinging 'U' shaped structure with a rod in the middle going up into the inside of the bell suspending it. This eliminates any dead portion and enables the bell to be supported by a clapper. Casting this bell and its design is truly a world event because this is the first time a lawful geometric etheric form has been cast.

What connection does a Chestahedron have to the human heart?

Finding this new lawful geometric etheric form meant that a new process based on expanding a platonic form rather than the usual reductive approach of compressing or truncating can now be used. In my approach and understanding, this seven-sided form lies between warmth and light, which is the area of the human heart.

When this form was spun on the end of a high-speed drill at an angle of approximately 36 degrees, a type of pocket-shaped vortex developed. I sculpted a model of this vortex and in cross-section; it resembled the cross section of a human heart. I found the Chestahedron is balancing between accelerating and decelerating vortexes. This form is a brake. I concluded that the heart's basic form and function is not to pump blood but to regulate blood flow. For example, the faster the heart beats the less the blood flows, therefore it is not a pump but a regulator. Also the apex of the heart is paper-thin and would blow out if the heart were just a pump. This discovery means that we can talk about the heart objectively as it is following lawful geometry.

What is the significance of casting the bell in Sheffield?

This bell has been around in my workspace for ten years and Aonghus was the first person to pick it up. I kept asking myself: Why England and why Sheffield? When I visited the Millennium Galleries in Sheffield, I understood why, because of the craftsmanship and heritage of working with metal that has been going on for 700 years or so. The Liberty bell, to celebrate independence in the USA, was cast here in England in 1752 and so this country has a long history of making bells. I went to many bell casters in California to get one of these bells made for myself but no one would combine 15% of tin with 85% of copper. Why? Well, since the Second World War, they quit using tin, replacing it with silicon and never returned to using tin again.

And what of the future?

I have envisioned using my techniques of stirring and moving water with Chestahedron variations to develop new ideas in biodynamic preparations and embryology studies.
I would like to thank the whole team of Teachers, Craftsmen, Staff, Students and Helpers at Freeman College who worked so hard in making the Heart Bell possible. It was a joy to work with you all.

Aonghus & Frank watch expectantly as the new bell is cast

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Exhibition Accompanying the Casting of the Heart Bell

The Exhibition and the Panels below were curated and designed by Carole Baugh, Arts Co-ordinator

From Drag to Cope

The drag is built up in layers to form the interior profile of the bell. The first layer of loam is bound with the rye straw rope.

A second layer of loam is applied over the straw rope and smoothed back with the wooden strickle, allowing a 2cm space for the final coating. The drag is dried out at this stage.

Journeyman Blacksmith, Duncan Ince, carefully wraps the straw around the loam.

After the drag has dried out the strickle is changed to the outer profile of the bell. Clay is built up on the drag, creating the pattern for the outer mould or 'cod'.

The clay cod surface is worked to a smooth finish and painted with cellulose primer, which can be sanded down with wet and dry paper. Attention to the finished surface at this stage cuts down machine sanding of the much harder bell metal after the casting.

Once the cod is dry the finished mould is dusted with parting powder and placed in a stack of casting boxes. The boxes, added one at a time to the stack, are packed or 'rammed' with casting sand.

The outer profile of the bell, now imprinted into the sand, is the 'cope'; quite literally the outer coat of the bell mould. A cope is also a liturgical vestment or cloak. The mould is enclosed in the casting boxes while the cope hardens.

When the cope is hard the casting boxes are separated revealing the external profile of the bell. The clay waste is carefully removed.

The cope is placed back on the drag in the casting boxes. Feed holes for the molted bell bronze pass through the sand mould. The mould is ready for the casting process.

Process and Materials

Instructed by bell caster Bill Benton, students and staff at Freeman College, Sheffield build three bell moulds. The two small moulds are used to cast test bells during the first firing of the furnace. Casting the test bells allows all participants to learn their roles during the final casting of the large bell; a 3 cwt bronze bell.

Each mould is built using traditional materials and techniques. Set perpendicular in the base of a sand filled casting box, is the 'pintle'. The pintle is an upright metal post, to which a 'strickle' is attached. The strickle is a board cut to the profile shape of the bell. Once the strickle is attached to the pintle it must be free to circumscribe the loam, which forms the 'drag' or 'core'; the interior of the mould.

The drag, initially built up with ballast, is plastered with a loam of wet sand, horse manure and coal dust. The horse manure is treated by heating it over a shallow pit fire on a sheet of corrugated iron, resulting in a product that is clean, dry to handle and has the consistency of tobacco.

Student, Sammy Leighton treating the manure in Land Skills at Eyam, Derbyshire.

Straw rope is wound tightly into the loam. Students made straw rope during their practical Land Craft sessions with tutor, Ralph Sixsmith.

Rye is used to make the rope for the bell moulds. Spinning rope requires the longest straw possible; rye straw is mainly grown for craft use and can be up to 1.5 metres long. The straw is dampened over night and hand twisted before fitting it onto a 'whimble'; a specialst tool for straw rope spinning.

Student, Ricky Bagley using a whimble.

High fibre materials, such as straw rope and manure, burn away during casting. This allows a shrinkage space in the mould to prevent the bell cracking as it cools and contracts. The sand constituent of the loam is Mansfield Sand which, with its high clay content, acts as a binder with the other ingredients.

Recycling and Refurbishing the Furnace

The furnace was originally built in 2002 to cast Ruskin Mill Educational Trust's second bell at sister college, Glasshouse. Designed by the Glasshouse bell casters, the furnace consists of high temperature refractory bricks and has an arched ceiling. The arched ceiling strengthens the furnace roof and deflects heat down into the metal. The bricks are held together with fire clay on the inside and lime mortar on the outside. To allow for ease of movement and to raise the furnace height, it is built on a bogey, a platform on wheels, fished out of the Stourbridge Canal.

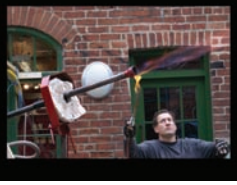
After casting the Glasshouse College bell, the furnace remained outside, exposed to the elements. In 2010, Freeman College students and staff brought the furnace to Sheffield for refurbishment. The ivy, which had grown through the crumbling mortar, was removed and new bricks and mortar replaced damaged areas of the furnace. The bogey was sanded down and repainted.

Students, Sarah Ansell and Thomas Stockton refurbish the furnace.

Once the furnace was almost in firing condition, the bogey was pulled by tractor to the casting site; Freeman College's flagship development, Sterling Works.

Student, Becky Gray, applies a layer of fire clay to the inside of the furnace. This final layer of insulation is applied after the furnace arrives at the firing site to prevent cracking during transportation.

Accessed from a nearby college workshop, gas fuels a burner inside the furnace. A blower mixes air with the gas, increasing the temperature. Furnace designer, Tony Ind checks the gas connection and pressure in preparation of the first firing.



Tradition and Renewal

The casting boxes are clamped together ensuring stability in the mould during the pouring and cooling process.

The gas pipe is placed in the furnace and the temperature is slowly increased.

Temperatures of 1370˚C are reached inside the furnace. With the melting point of bronze at 1080˚C and a casting temperature of approximately 1200˚C, the furnace was built with a spare heat capacity of 100˚C.

Bell metal is an alloy made of 80% copper and 20% tin. Recycled copper and copper wire stripped from reclaimed telephone cables during Freeman College's building redevelopment is used to cast the new bell.

Copper, a natural conductor and telephone wires, as transmitters, resonate as signifiers of the role of the bell.

As the furnace temperature reaches approximately 1000˚C, bell caster, Bill Benton leads the furnace loading with the copper.

Tin ingots are added to the molten copper. The metals are mixed with willow sticks to flux the metals together.

When the metal forms a pool inside the kiln, the impurities or 'slag' is removed from the surface of the copper.

The pouring hole bung is released and the molten copper runs into ingot casting boxes. These ingots are used to cast the Heart Bell.

More Preparations and the Test Casting

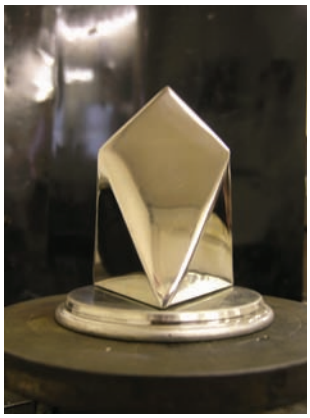
Jason *making a Chestahedron model*

Ricky with Duncan working on the cod

A copper cow bell made with students

Frank with Pewter tutor, Danny Rowan

Copper tutor, Graham Oldfield with Lee



A pewter Chestahedron made at the college

Bill and Laura working on the straw rope

Brandon working on the furnace

Becky also working on the furnace

Ricky cleaning up the gas and air blower

Sam sieving the sand

Chris painting the gas and air blower

Left: The small bell freshly out of the casting moulds. Right: Per Iversen ringing the bell in its raw form with Ralph and the central pole design that will hold the bell

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Casting the Heart Bell

The bell casting team was headed by Bill Benton who has cast the previous bells at our colleges. Bill was assisted by Carole Baugh, Duncan Ince, Danny Rowan, Ralph Sixsmith and student Thomas Stockton, as well as hands-on support from many staff and students at Freeman College. The team also included Tony Ind and Paul Gittins from Glasshouse College. Ralph takes up the story as the casting unfolded.

Bill making final preparations to the mould or cod

The furnace is powered by natural gas from the gas main and electricity from a studio. There will be approximately 160 kgs of copper, 40 kgs of tin, 5 kgs of phosphor copper and a small amount of gold. These materials will be in the furnace for as long as necessary and melted. We hope this will be enough to cast the bell but we have spare copper and tin if necessary. The furnace was brought up from Glasshouse College following their bell casting six years ago. The six casting boxes have been borrowed from Brass Founders in Sheffield and are one of our sponsors. We have been working on this project since Easter and initially went down to Stourbridge to look at the furnace, then transport it up here.

Frank Chester watching Tony Ind load the metals into the furnace

We have refurbished it with some of our students which included taking the burner out and sorting the bricks out. The major problem has been the weather as it is in the courtyard. We got the moulding sand from Brass Founders and added Bentonite or dry clay which holds the shape of the cast when it dries. The drawings had to be made to scale and conform to Frank Chester's geometric plan according to the Chestahedron. This

The box being carefully lowered over the mould.

Aonghus addressing an expectant gathering

Sandra Thomas filming James sending gold down the shute

Boiling metal breaks loose into the slag pot

shape has never been cast before, as far as we know. We had to get straw to make straw rope for the centre of the bell mould and this was made by the students in Sterling Works courtyard. All the boxes for the bell mould were filled with sieved sand around the drag (centre) of the bell to form the mould proper. When dry, these were lifted off to reveal the exterior of the bell. We then removed the clay from the centre of the bell and cleaned up the inside of the mould to get the best finish possible. We put the moulding boxes back over the model, bolted them together and fitted a slag pot into which we will pour the molten metal.

Below: Following an initial problem with a leaking box, Bill and team breaking the plug to let the metal run into the mould

Once cooled the Heart bell was revealed for the staff and students of Freeman College to see. The next stage for this 2.5 cwt bronze bell is turning and tuning. We will not know the note that this bell makes until it is can hang freely, allowing its natural voice to be heard.

Ralph Sixsmith, tutor

The Heart Bell now awaiting cleaning, polishing and tuning. Picture by Carole Baugh

We would like to thanks our sponsors: ***The Church Burgesses, The Graves Trust, The Sheffield Town Trust, Brass Founders Sheffield*** *who have supported the bell project from its inception and have advised, lent and supplied equipment to the project. Our thanks to* ***MFH*** *who turned out at 6am to move the furnace from Eyre Street to Sterling Works.*

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