

Design Resource

## Brass Metal Casting - Mannar, Kerala

Bell Metal Town

by

Prof. Bibhudutta Baral and Hariharasudan T.  
NID Campus, Bengaluru

Source:

<http://www.dsource.in/resource/brass-metal-casting-mannar-kerala>



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## Introduction

Mannar is known as the Bell Metal Town, it is town in Chengannur taluk Alappuzha district of Kerala state, India. It is the second biggest destination for metal products in India, after to the city of Moradabad, U.P. Mannar is situated on the banks of the Pampa River, Manimala River and Achan Kovil River.

Mannar occupied importance in the annals of Travancore history. On the northern side of the Shiva temple, known as Padanilam, a decisive war (1741 A.D.) was waged between King Marthanda Varma and the Kayamkulam Raja in which the latter was defeated and had to enter into an agreement with the former. This treaty is known as Mannar Treaty.

It is believed that about 200 years ago during the king's rule a community known as Vishwakarma was invited from Shankarankovil and Tanjavoor of Tamil Nadu to build temples. It was a tedious and time consuming process so those people got settled in Kerala. Then they started moving around to build temples in other places. Soon after, many of those people started to do works individually like making idols, bells etc. and the metal handicraft became their profession. There are hundreds of traditional 'ALA'S'(kilns or furnaces) in Mannar. There are many small-scale manufacturing establishments engaged in this business, employing traditional workers.

Bell metal, brass and bronze are called red metals also. Bell metal is a heavy metal having the density of 8.7 gm/cm<sup>3</sup> and a very high melting point of 1500°C. It is the mixture of copper and tin in the ratio of 78% and 22% respectively. It gives a resonating sound and this is the main reason of making bells out of this alloy. The resonating sound comes because the atoms in the crystals of the alloy can interchange their positions when we struck the bell. This alloy has a rare property of expanding slightly when it cools down. Thus the fine cracking or gaps in the mold are covered automatically. It is costlier and harder than other metals and alloys used and difficult to work on while finishing.

Some of the unique works of the Mannar craftsmen include the world class products like the world's biggest cauldron placed in an antique shop in Jew Town in Kochi, the world's biggest church lamp at Kuravilangad Church, the world's biggest temple lamp at Chettikulangara Devi Temple, the world's biggest temple bell at Shimla Temple, the world's biggest church bell at the Cathedral Church, New Delhi and the replica of the famous 'Tree of Life' and the 'Knowledge Lamp', the 17 century bronze sculptures for a museum in Chennai.

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Molds are kept for drying. They have small pieces of tiles on their surface which is put to provide necessary strength to withstand against the high temperature while melting wax.



Crucibles containing molten metal are kept ready to be poured into the cast.



Artisan taking scrap metal to heat and process them into molten metal.

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Honeybee wax kept in a container.



Clay is being applied to make the mold. Wood is used as support.

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Small sized molds are being kept inside the clay, ready to put the casting.



The mold is being given shape by the artisan by sculpting with a handmade tool.



Wax is being applied by the artisan on the clay mold.

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There are multiple holes (vents) which help to assist in the escape of gases that are expelled from the molten metal during the solidification phase of the metal casting process.



Molds are kept for drying after application of clay.



Urli clay mold is being kept warm in order to dry the wet clay.



A metal piece being beaten into smaller pieces.

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A clay mold having small pieces of tiles on its surface for strength.



Clay molds of lamps are kept on hot charcoal to dry the clay.

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Molten wax being collected into a vessel which can be reused.



Artisan is cutting two logs of wood and checking if it's of equal measure.



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At the time of pouring molten metal, wet jute sack is used as a shield from flames and spilling of molten metal on to the feet of the craftsman.



Artisan applying layer of wax on clay mold.



The team of artisans who prepare Brass Metal Urli posing with their product.

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## Tools and Raw Materials

Following are the tools and raw materials required for brass metal casting:

- **Hammer:** Iron hammers are used in chiseling for engraving and finishing purposes, breaking big chunks of raw materials including metals and clay. The wooden hammer is used for beating and smoothen the wax before it is applied on the mold.
- **Files:** Used for smoothening the irregular surface and edges of any surface.
- **Blower:** Used to provide enough air in the furnace while melting the wax or metals in the crucible.
- **Crucible:** Crucibles are mud pots, used to heat and melt the specific metals.
- **Pincers:** It is a gripping tool used for holding crucibles and is very much similar to a normal plier that its handles are very long comparatively.
- **Drilling Machine:** It is a hand operated electric device used for making holes on metal.
- **Lathe:** Machine tool that rotates the workpiece on its axis to perform various operations such as cutting, drilling, facing, turning, with tools that are applied to the workpiece to create an object with symmetry about an axis of rotation.
- **Chisels:** It is a hand held flat blade, small ones are used for shaping the edges and bigger ones are used with hammer for engraving designs.
- **Narayam:** It is made up of iron and has wooden handle. It is a small wooden piece on which smaller molds are made by hands and after making molds these are kept in a pit for waxing. Then it works as the central axle while turning the mold in that pit.
- **Achukol:** It is also made from the wood of Poovan tree. It is big in size and is used for making the bigger molds manually.
- **Arippa:** It is nothing but the sieve used to filter the finely powdered sand.
- **Barzing Machine:** It is used for joining different pieces of the brass using a flame and a filler material.

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- **Chopper:** It is a special heavy weight knife used for chopping jute sacks into smaller pieces which are added into clay to provide fibrous structure to the mold and thus making it strong to withstand against the heat while melting the wax. This tool is made up of iron.
- **Kada Irumbu:** It is a tool used for smoothening the wax applied on the mold.
- **Spade:** Used to remove mud or material from a place.
- **Roller Stone:** It is a hand operated grinder used for grinding the baked-broken mold clay pieces into powder.
- **Compass:** It is used for marking the measurements and making perfect circle wherever needed.
- **Thadi:** It is used for flattening the wax.
- **Mattam:** 'L' shaped perpendicular ruler used for measuring perpendicularity of two surfaces.
- **Cutting and Grinding Blades:** It used to cut and grind the unwanted pieces from the edges and surfaces of the product.
- **Sander Blade:** It is used to smooth the rough areas of a product.
- **Honeybee Wax:** It is used for making the model and can be collected and reused.
- **Clay:** It is used to make molds and can be recycled.
- **Rubber Tree Wood and Coconut Husk:** It is used as fuel to generate heat for casting process.
- **Bell Metal:** It is a heavy metal having the density of 8.7 gm/cm<sup>3</sup> and a very high melting point of 1500°C. It is the mixture of copper and tin in the ratio of 78% and 22% respectively. It gives a resonating sound because the atoms in the crystals of the alloy can interchange their positions when we struck the bell.
- **Brass:** It is the alloy of copper and zinc in ratio of 60% and 40% respectively. Its melting point is 900°C and the density is 8.4 g/cm<sup>3</sup>.
- **Bronze:** It is the mixture of copper, zinc and tin in ratio of 85%, 5% and 5% respectively. It is reddish in color having higher melting point of 950°C than brass because of the presence of tin. Its density is 8.6 gm/cm<sup>3</sup> and it gives a clear ringing sound.

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- **Copper:** It is a metal with reddish orange color and melting point of 1084°C. It's highly malleable, soft and ductile. It's a good conductor of electricity. Its density is 8.9 gm/cm<sup>3</sup>.
- **Zinc:** It is lustrous metal silvery grey in color and have a melting point of 919°C. Its density is 7.14gm/cm<sup>3</sup>.
- **Tin:** It is a very hard in nature, silvery white metal and have melting point of 231°C. Its density is 7.36gm/cm<sup>3</sup>.



Scrap Metal: Used to heat into molten metal.

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Rubber Tree Wood: It is cut into desired shape used as fuel to generate heat for casting process.



Roller Stone: It is hand operated grinder used for grinding the baked-broken mold clay pieces into powder.

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Crucibles: These are made of special type of mud to withstand very high temperature; they are used to carry molten metal.



Iron Hammers: Used in chiseling for engraving and finishing purposes, breaking big chunks of raw materials including metals and clay.

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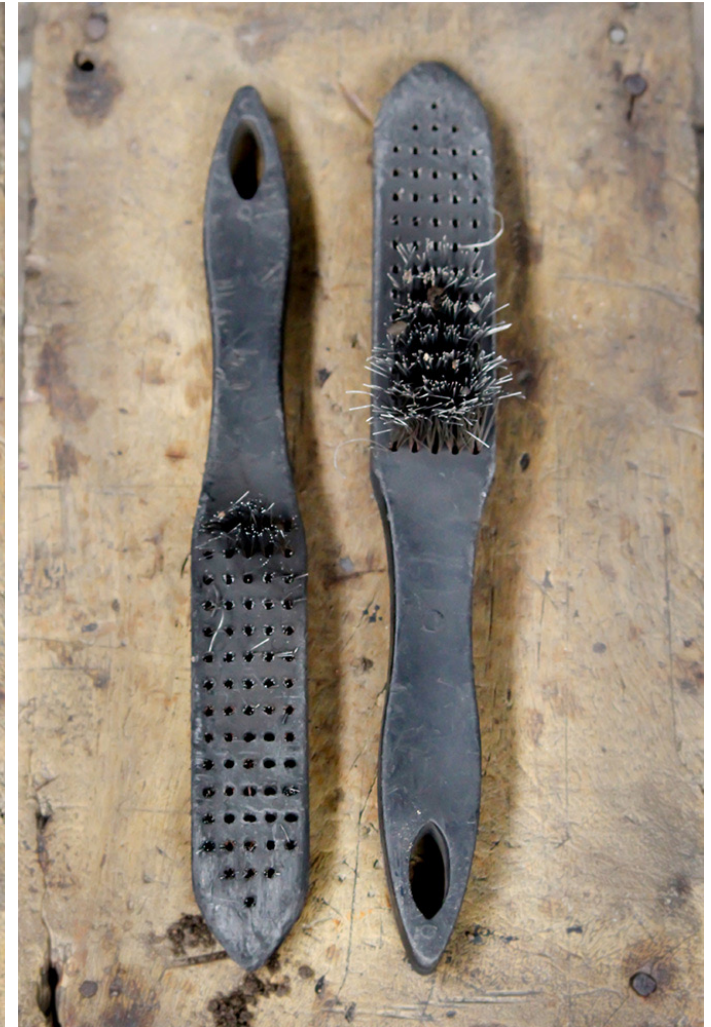
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Chisels: Hand held flat blades, small ones are used for shaping the edges and bigger ones are used with hammer for engraving designs.



Metal Brush: Used to clean casting after removing the mold.

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Spade: Used to remove mud or material from a place.



Clay: used to make molds and can be recycled.



Bricks: They are used to construct a furnace around the mold to heat it.



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Tongs: To hold small size hot castings after removing from mold.



Weighing Machine: Used to measure the exact quantity of metal to be melted.

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## Making Process

The process used for casting is known as “Lost wax method”.

- The casting process starts by preparation of the mold.
- A mixture of clay, cow dung and recycled clay from the previously used and broken molds are mixed together.
- This mixture is made to a dough consistency and applied around the achukol of desired shape to make utensils, to make idols and figurine, first step is to sculpt the idols using honey bee wax.
- After the mold is dried, the wax is applied around the mold for desired thickness. In case of idols and figurine, a mixture of clay, finely cut jute sack and recycled clay is applied on the wax.
- For easy and even application of the wax the achukol is mounted in a pit so that it can be rotated.
- Thickness of the wax depends on the product been cast and its kept in sun for drying.
- Once the wax is dried a mixture of clay, finely cut jute sack and recycled clay is applied on the mold.
- Orifices are made on the mold for pouring the molten metal and draining of the molten wax and gases formed during casting.
- On outer surface of the mold, small tile pieces, of broken molds, are fixed to provide necessary strength to withstand against the high temperature while melting the wax in furnace.
- This completed mold is allowed to dry for 4 days under the sun.
- The dried mold is set on fire for melting the wax inside and the molten wax is collected using a vessel, which can be reused, during this 50% of wax is lost. During earlier days the wax used was not collected and it used to evaporate as fumes and gases, so the name Lost wax method.
- The furnace is constructed all around the mold without allowing any gap around it and it is placed slightly elevated from ground in order to set fire below the mold.
- Simultaneously the raw metal or alloys are weighed, according to the desired alloy for casting and filled in crucibles. For bell metal the ratio of copper: tin is 4:1.

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- Crucibles are made of special type of mud to withstand very high temperature.
- The ratio of weight of wax and alloy required to cast the product is in the ratio of 1:10 which means if the wax model weighs 1 kg then the casting will weigh around 10kg.
- Crucibles are filled with the required quantity of the metal and placed in the furnace for melting.
- Looking at the color of the flame in the fire vent craftsmen can easily identify whether the raw metal is molten or not.
- The normal flame is reddish yellow but the flame coming out from the molten metal is distinctively greenish blue in color.
- After the molten wax is completely drained, the mold is moved to a new pit which is made to accommodate the mold for casting.
- The drain holes are plugged and mold is placed in the pit covering with sand all around firmly. Only the holes for pouring the molten metal and vent holes are spared and rest are covered completely with the sand.
- The crucible is removed from the furnace and molten metal is poured into the mold through the holes provided.
- At the time of pouring, wet jute sack is used as a shield from flames and spilling of molten metal on to the feet of the craftsman.
- Molten metal is poured into the mold while the mold is still hot in order to avoid sudden cooling and breakage of the casting.
- The casting is allowed to cool & set for 12 hours and mold is removed from the pit and casting is taken out of the mold.
- The casting obtained is unfinished and further processing is required.
- The clay sticking to it is scraped and the extra projections are cut off using a hand grinding machine.
- Any rough edges present are removed and polishing is done with liquid metal polish.

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Scrap metal is beaten into tiny pieces to be melted into molten metal.



Metal pieces are being burnt.

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Broken mold clay pieces collected together.



Artisan uses the powdered clay, adds water and makes it into a paste. This paste is made into the shape desired (in this case, urli). Artisan turns excess clay from the mold to remove excess and give it a definite shape.



Artisan using roller to grind the clay pieces to powder.

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The furnace is constructed all around the mold without allowing any gap around it and it is placed slightly elevated from ground in order to set fire below the mold.



The dried mold is set on fire for melting the wax inside and the molten wax is collected using a vessel, which can be reused.



Artisan making a pit in the ground to accommodate the mold for casting.



The furnace built around the mold using bricks are being removed.

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The mold is being moved to the pit made in the ground.



Mold is placed in the pit covering with sand all around firmly. Only the holes for pouring the molten metal and vent holes are spared and rest are covered completely with the sand.



Molten metal is poured into the mold while the mold is still hot in order to avoid sudden cooling and breakage of the casting.

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A close-up shot of molten metal poured into the holes of the mold. There are multiple holes (vents) which help to assist in the escape of gases that are expelled from the molten metal during the solidification phase of the metal casting process.



Stones are kept on it to mark the position of the mold.

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After the alloy solidifies in the mold it is taken out from ground and the clay is broken using hammers.



Chisels are also used for this purpose if the product is a fine detailed one having minute details.



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The casting is obtained but is unfinished and further processing is required.

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## Products

Product list include Lamps, vessels, bells, statues of gods and goddess, famous personalities, decorative items etc. Some of the most important household products which are made on regular basis are:

**Kinnam Plates** for taking foods like kanji and boiled rice.

**Uruli** a vessel used for decoration.

**Chembu** for boiling paddy.

**Kindi** a vessel for taking water for washing.

**Naazhi** a hollow cylindrical vessel used for measuring grains.

**Sevanaazi** is a cylindrical shape vessel, with a rotating handle on the top and small holes at the bottom used for making idiyappam, murukku etc.

**Vaarpu** is a large bowl made from bronze. It is used for making Ayurveda medicines and meals during festivals in homes and temples.

Different kinds of lamps like Thamaravilakku, Aaluvilakku, Vaasthuvilakku, Thookuvilakku, Ashtamangalyavilakku, Lakshmivilakku, Aamavilakku, Mayilvilakku and Nilavilakku.

Some of the products made in Mannar are so big, that they are biggest in the world and some have entered into record books. For example Ernakulam district, has a huge lamp in 9 layers where 1000 wicks can be lit and it has an entry in Limca Book of Records in year of 2007. It is 24.5 feet in length and 6000 kg in weight.

In Bhopal at Indira Gandhi Rastra Manava Sangralaya, a lamp called Aaluvilakku which is 14 feet in height and 2500 kg in weight is displayed.

World's biggest temple bell is at Mohan Nagar in Shimla which is 6.5 feet in length and 3.5 ton in weight. **World's biggest cauldron is at an antique shop in Jew Town in Kochi.**

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A perfectly made urli having animal depictions around it. Natural lotus plants are grown inside it.

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Statue of Indian lord Shiva in the form of Sri Nataraja (Lord of Dance) crushing Apasmara (dwarf who represented ignorance and epilepsy) with his right foot.



Dancing figure of Shiva Nataraja within a circle of fire. Shiva's lower right hand makes the abhaya mudra gesture of blessing which calms all fear, and the lower left arm sweeps across his torso with the hand pointing to his left foot in the gesture of gaja hasta, symbol of salvation and liberation. Shiva's right foot is shown stamping on the dwarf figure Apasmara Purusha, who holds a cobra and who represents illusion and ignorance, leading humanity away from truth. The cobra motif is repeated and hangs slain from Shiva's right arm. The god usually wears only a short dhoti which is tied around his waist with a sash. Typically, the two ends of the sash billow to the god's dancing movement and reach out to join the ring of fire. Shiva also wears jewelry – necklaces, armlets, and anklets.

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Top view of an urli having a lotus. It is used for decoration purpose.



Brass metal of a Horse used for decorative purpose.



Church bell made of brass metal. It is rung in a church either to signify the hour or the time for worshippers to go to the church, or to attend a wedding, funeral within the liturgy of the church.

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Aarti Diya used at homes and temples while worshipping. It gives the user a comfortable grip to hold the Diya. It has stands on either side to keep it on the ground.



Brass Diya stand in the shape of a tortoise. The tortoise is a symbol of wisdom and knowledge, and is able to defend itself on its own. Creation is associated with the tortoise and it is also believed that the tortoise bears the burden of the whole world.



This deepam is called kuthu vilakku. Kuthu Vilakku is lit to signify the beginning of any event or occasion. It signifies the three Gods Brahma, Vishnu and Shiva who are believed to be present in the Vilakku. At the base part is Brahma, the middle part Vishnu and the broad part on top is Shiva. The glow of the vilakku is represented as Goddess Lakshmi, the Light by Goddess Sarasvati and the Heat by Goddess Parvathi. The five petals or nozzles are said to represent the five elements of Nature — earth, water, fire, air and sky or space.



Two different shaped pots/tumblers used in temples.

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## Brass Metal Casting - Mannar, Kerala

Bell Metal Town

by

Prof. Bibhudutta Baral and Hariharasudan T.

NID Campus, Bengaluru

Source:

<http://www.dsource.in/resource/brass-metal-casting-mannar-kerala/products>

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Brass vase to keep flowers, used as décor.



Vintage style brass metal container used to preserve turmeric and vermilion.

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Brass tea pot, this is a vessel used for steeping tea leaves or an herbal mix in boiling or near-boiling water, and for serving the resulting infusion which is called tea.



Traditional Indian Lota made of brass metal. The lota is used in religious activities, like Hindu puja. When used for Hindu worship, it is often decorated with sindoor and/or turmeric powder.



Brass bell with Nandi (bull which serves as the mount of the god Shiva) on the top used at homes and temples for worshipping. Nandi is said to be the gatekeeper of kailasa parvat.

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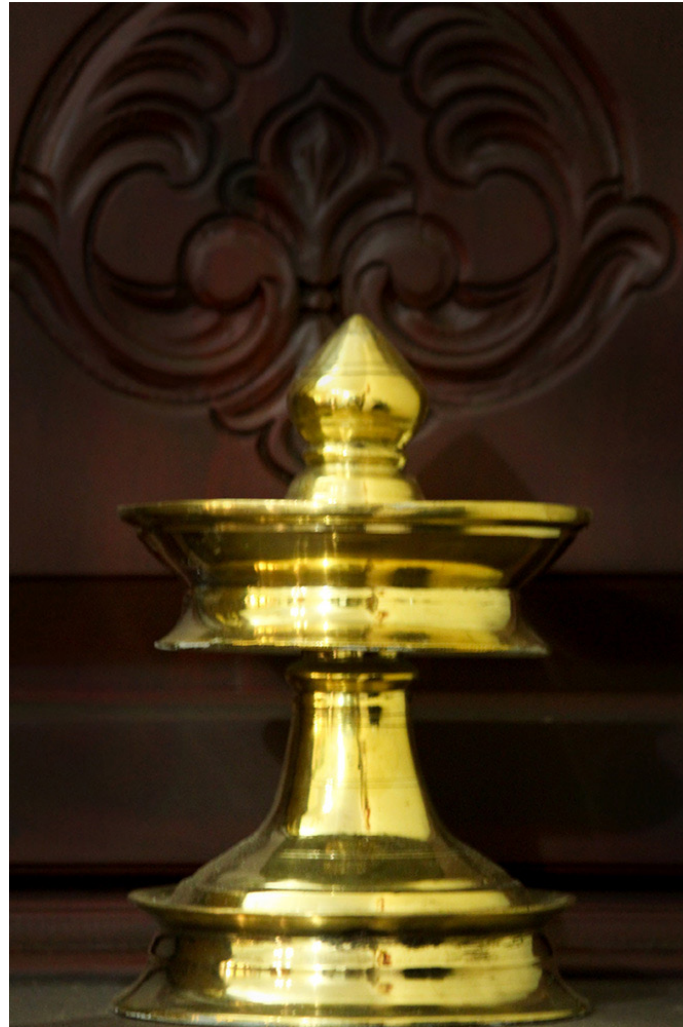
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A short Brass Lamp called as Nilavilakku. Nilam in the Malayalam language means floor or the ground and vilakku means lamp. The Nilavilakku is integral to several rituals and ceremonies in Hindu families in Kerala.



A life-size Nilavilakku used at homes and temples. Lighting the Nilavilakku on any occasion is believed to be auspicious.

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Nilavilakku about 12 inches in height.



A branched Nilavilakku having 9 diyas. Nilavilakku is the symbol of Shiva Linga.

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## Video



Brass Metal Casting Part 1 - Mannar, Kerala



Brass Metal Casting Part 2 - Mannar, Kerala

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## Contact Details

This documentation was done by Prof. Bibhudutta Baral and Hariharasudan T. at [NID Campus, Bengaluru](#).

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