National Third - Energy

Modified boiler based *mawa* maker

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Mawa is an important milk product used to make sweets. It is traditionally prepared by boiling milk until it becomes semi-solid by heating it over firewood. Subhash Ola (35) has made modifications in the boiler of conventional *mawa* making machine making it energy efficient.

Background
Subhash hails from a farming family of Alwar and has three siblings. Though he was very good in studies, he had to drop out to assist his father. Apart from farming, his father also used to drill bore well. Subhash was initially engaged in bore well digging, then he took up farming and tried his hands at computer assembling as well. He married early and has two daughters and a son, all school students presently.

As a child, looking at the silencer of vehicles, he used to wonder whether the hot air emitted by silencer could be used in any way. He had deep interest in steam based technology. In class 8th he developed a small steam turbine of ½ kW where steam was recycled. The turbine could light a bulb of 6W. With time, his interest in steam technology grew further and he undertook more research on steam technology on his own. In 2000 he developed a 2 kW engine with a modified design. Later in 2013, he designed anefficient heat exchanger for exhaust steam of a steam engine and the feed water (economiser).

Genesis
Traditionally, *mawa* is being made in *kadai* on an open stove by burning fire wood. An improved technique for the commercial production of *mawa* is by making use of steam for heating milk. In place of direct flame heating, the wood is burned in the boiler and steam produced is distributed to a number of *kadais* fitted with steam jacket. After heating the milk, exhaust steam is collected at bottom and condensed in open tank. As the systems are not properly fitted, a lot of steam escapes from various joints. These leakages reduce the efficiency of the system, which results in higher steam consumption, more wood consumption and also more of the water. As the water used in steam generation is normal (untreated) water, higher throughput of steam causes more scaling in boiler, further reducing the heat transfer efficiency and also the life of the boiler.

Subhash saw a boiler based *mawa* making machine at an industry in Jaipur. At that point of time, he was trying to design improved boilers. After interacting with the industry person he got perturbed by the amount of wood and water consumed to make *mawa*. The machine used over 100kg of wood and 4000lit of water to extract *mawa* from 100 lit of milk. It also consumedconsiderable amount of electricity for running chiller pump to condense the rejected steam, making the whole process very costly.

He started to improve the design of boiler in the *mawa* making machine and after almost ten years of hard work, he successfully developed the improved boiler based machine for making *mawa* in year 2009.

Modified Boiler based *Mawa* Maker
This is a *mawa* maker where the steam circuit (boiler, *kadai*, condenser, pipes) has been made as a closed leak proof design resulting in better fuel efficiency and minimal wastage.

The used steam is also fed to the boiler alongwith condensate water through gravity. The close circuit design stops leakages, thereby reducing the additional water requirement (reducing from 1ton per hour to few liters per hour). Also the wood consumption has reduced drasticallyusing redesigned boiler with horizontal fire tubes, preheating of air with flue gases, and recycling of the steam back to boiler without condensation. The water filled in the boiler can be continuously used for a long time unlike traditional *mawa* machines, where it has to be filled almost every half an hour.

Further to reduce human efforts, he has made the stirring operation automatic. In conventional practice of *mawa* making in *kadai*, continuous stirring is needed to prevent milk fat from sticking to the walls of container. For this, at least one person is needed at each *kadai*. Subhash has designed an automatic machine, which can process 10-12kg milk in a single batch with mechanized stirring and unloading of the prepared *mawa*. The heating requirements are accomplished by steam supplied from a wood fired horizontal fire tube boiler in closed circuit. The boiler is supplied with preheated air (heated using flue gases) by a blower, which is connected via a pressure actuated switch. The automatic operation of the boiler and machine reduces the wood consumption per unit of *mawa* produced considerably, while saving labour costs. This concept can also be used for efficient heating in dairy & food processing, textiles, rubber, plastic industries.

Subhash is making machines with capacity ranging from 40 lit/h to 3000 lit/h (Costing Rs 60,000 to 10 lakh) depending on demand of customers. He has sold over 60 machines in different parts of North India.

In all his creative pursuits, his mother has been a continuous source of help though his father believed he was wasting money. Being in a joint family also helped as he never had the pressure to make ends meet. A couple of other people also helped him to file a patent and generate resource for his work.