Final Report
On
PEDAL OPERATED RICE MILL AT HOME SCALE

Submitted to :

Department of Science & Technology
Government of India, Technology Bhavan
New Mehrauli Road, New Delhi – 16

Implementing Institute

Manipur Science & Technology Council
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1.	**Title of the project**	:	Pedal Operated Rice Mill at Home Scale
2.	**Principal Investigator**	:	Shri Th. Surendranath Singh Manipur Science & Technology Council, Central Jail Road, Imphal
3.	**Implementing Agency**	:	Manipur Science & Technology Council, Central Jail Road, Imphal
4.	**Date of commencement**	:	22.8.1997
5.	**Planned/Actual date of completion**	:	28.2.2000

6. **Objectives as stated in the project proposal** :

   i) To bring out an overall improvement replacing the traditional devices of paddy dehusking of pounding.

   ii) To carry out paddy dehusking at home instead of sending to the rice mill.

   iii) To introduce a new technology of paddy dehusker which will be acceptable to the rural areas.

7. **Introduction :**

As of to-day, in the rural household, throughout the Country the rural people use pounding method for dehusking paddy for obtaining dehusked rice. In this traditional method a wooden mortar having one or more shallow pockets for keeping the paddy and one or two rural women folk pound the paddy by means of round long wooden log of 5ft – 6 ft called pestle.

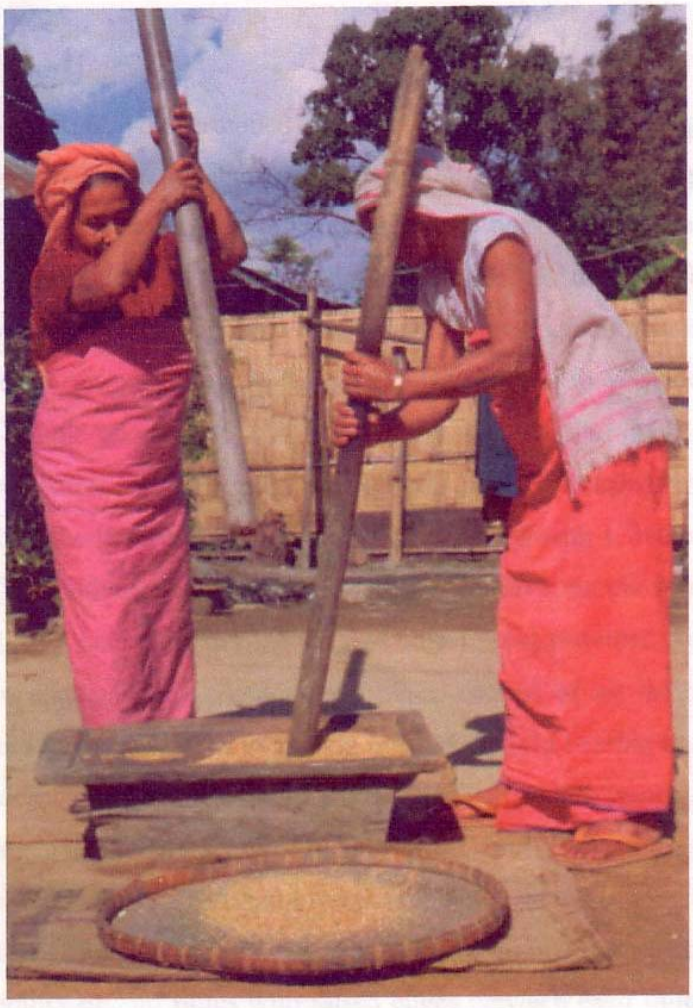
In this traditional method the mortar is at times made of stone also. However, for both mortar and pestle the rural folk cut down trees thereby depleting the natural wealth.

There being millions of rural household in the Country, large amount of wood is thus regularly consumed by the rural folk, which destroys trees thus upsetting ecological balance.

Another drawback of the pounding method is that, it takes a long time, uniform product cannot be obtained and rice grain is often broken.

There are also available Power Operated Rice Hullers, such as Baby Huller operated by low power electric motor of around 2-3 H.P or Diesel Operated Huller using higher H.P. motor of up to 10 H.P.

Traditional Mortar and Pestle



Pounding Method practised

Though the output capacity of these power operated hullers are several times more than the pounding method, this is not suited for rural condition, because of the high cost of the machines and power requirements. Furthermore, the diesel huller contributes to pollution problem. Additionally where such power/diesel-operated hullers are installed at community centers, the individual rural household people will have to track the distance both ways wasting time.

The purposes of this invention Pedal Operated Rice Mill is described below::

i) It does not occupy large floor space, and can be set up at any place, being portable.

ii) It can ensure an output of at least three times more than the traditional pounding method.

iii) It can simultaneously separate this rice from the husk to a substantial extent.

iv) It is also to mention that de-husking takes place by shearing action.

8. Description:

Pedal Operated Rice Mill provided a huller mechanism comprising of a frame work having ground support means to support the huller on the ground, a pair of pedestals, namely a front pedestal and a rear pedestal, a sitting arrangement provided on the rear pedestal, the forward pedestal being provided with the rice huller mechanism, the rear pedestal also having means for accommodating a freely rotatable crank operated by a pair of pedals, and provided at a level sufficiently below the seat, the forward pedestal being also provided with means for mounting a bigger crank adopted to be operated by the smaller crank. The rice hulling mechanism having a central shaft mounted through ball bearing housing, the outer end of the shaft extending beyond the ball bearing housing being provided with a free wheel adopted to be operated by the bigger crank mounted at a sufficiently lower level on the front pedestal, the free outer end of the said shaft extending beyond the free wheel being provided with a large fly wheel having one or more angular flaps adopted to provide current of air when the fly wheel is operated, the inner end of the said shaft extending beyond the said bearing housing being formed of three sections and accommodated within a housing a first section immediately after the ball bearing section having spiral section adopted to provide forward thrust to the paddy, followed by an intermediate section called a distributor section adopted to distribute the paddy on to a plurality of longitudinal fluted third sections. The third section being a comparatively larger section having a plurality of said flutes with raised edges between each flutes, the said housing accommodating the said extended shaft having the said three sections and being provided with a

sieve plate at it bottom section adopted to let husk to pan through and to retain the de-husked rice, there being provided a cover place on the top of the said housing having a paddy feeding chute and out let for de-husked rice, there being also provided an edge plate adopted to be close to the raised edges of the said flutes inside the housing.

The cranks are mounted freely rotatable by means of ball bearings adjacent the respective pedestals. The ball bearing housing of the front crank is mounted to the side of the front pedestals. The ball bearing of the rear crank housing is mounted adjustable preferably on to an upward inclined cross beam secured between the front and rear pedestals.

The ball bearing housing for the bigger crank is preferably mounted at a higher level than the ball bearing housing for the smaller crank.

The smaller crank is fixed and held to an axle whose intermediate end is held by the ball bearings and each free ends of which axle is provided with pedal means resembling those of an ordinary bicycle.

The bigger crank is fixedly held on an axle whose one end is held by the ball bearing and thereto provided a toothed wheel on the said axel alongside the bigger crank and wherein said axle extends into the huller housing with said three sections formed thereon.

A suitable chain connects the smaller crank and the toothed wheel while a second chain connects the bigger crank and flywheel.

The housing is preferably an open housing having support means for providing a removable curved sieve plate at its bottom end.

The housing is provided with a curved top cover plate either removable fitted or hinged connected.

The central shaft having the said three sections has the said third section occupying major portion of the housing.

The lower portion of the housing is provided with an adjustable end plate adopted to move towards and away from the said fluted axle.

There is provided a plate at the lower end of the feed chute/hopper for adjusting the inlet opening of the same.

There is provided an adjustable plate of the outlet end.

9. Operation of the Rice Huller is as follows: -

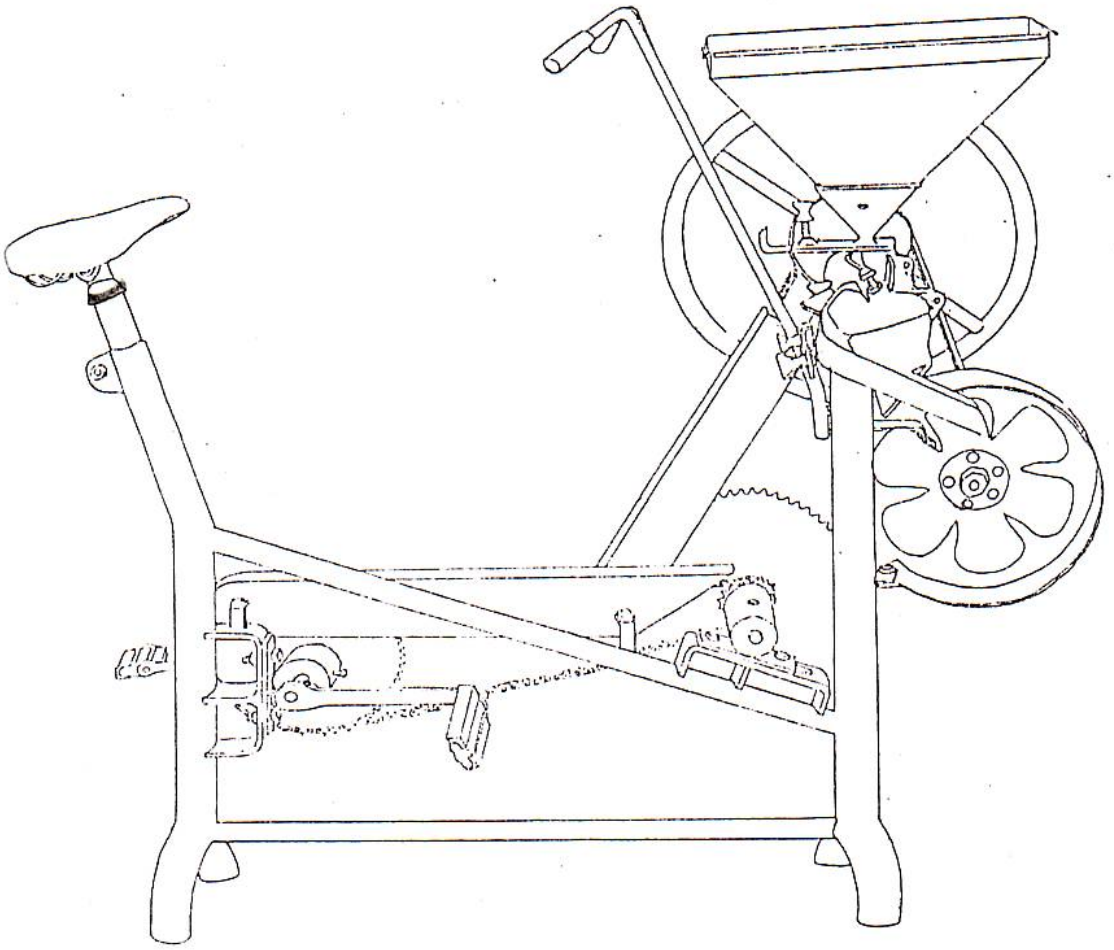
A Pedal Operated Rice Huller comprising a frame work having ground support means to support the Huller on the ground, a pair of pedestals, namely a front pedestal and a rear pedestal, a sitting arrangement provided on the rear pedestal, the forward pedestal being provided with the

Rice Huller mechanism, the rear pedestal also having means for accommodating a freely rotatable crank operated by a pair of pedals, and provided at a level sufficiently below the seat, the forward pedestal being also provided with means for mounting a bigger crank adopted to be operated by the smaller crank, the Rice Hulling mechanism having a central shaft mounted through ball bearing housing being provided with a free wheel adopted to be operated by the bigger crank mounted at a sufficiently lower level on the front pedestal, the free outer end of the said shaft extending beyond the free wheel. A winnowing fan having five angular flaps adopted to provided current of air when the fly wheel is operated, the inner end of the said shaft extending beyond the said bearing housing being formed of three sections and accommodation within a housing a first section immediately after the ball bearing section having spiral section adopted to provide forward thrust to the paddy, followed by an intermediate section called distributor section adopted to distribute the paddy on to a plurality of longitudinal fluted third sections, the third section being a comparatively larger section having a plurality of said flutes with raised edges between each flutes, the said housing accommodating the said extended shaft having the said three sections and being provided with a sieve plate at it bottom section adopted to let husk to pan through and to retain the de-husked rice, there being provided a cover plate on the top of the said housing having a paddy feeding chute and outlet for de-husked rice, there being also provided an edge plate adopted to be close to the raised edges of the said flutes inside the housing. The inlet closing plate of the hopper or chute is in the closing position and paddy is fed into the hopper. The person sitting on the seat then operates on the pedal thereby causing the flywheel to rotate and also the Huller shaft to rotate. The closed plate is slowly withdrawn to allow the paddy to fall through on to the spiral portion of the Huller shaft. The paddy is thrust forward into the distributor section, which distributed the paddy into the plurality of longitudinal flutes of the Huller-Shaft. As the huller shaft rotates, the paddy falls through the adjustable gap formed between the longitudinal raised edges of the Huller shaft and the edge of the end plate. Paddy is subjected to pressure and shearing action between the two edges and the husk is removed.

The husk and the dehusked rice fall on to the sieve plate where the husk and smaller grains of rice pass through the sieve plate. Similarly major portion of the dehusked rice mixed with some husk are forced through the outlet opening by the raised ends of the fluted rod.

As the flywheel rotates, the fan blades mounted on the front pedestal provide a stream of air towards the falling materials and the lighter husks are sifted.

Collecting baskets are put behind the sieve plate and below the outlet end for obtaining winnowed dehusked rice.



Schematic Line Diagram of
PEDAL OPERATED RICE MILL

Various areas of application

* The height angle of the handle can be adjusted to suit any build.
* Adjustment of the saddle for one's comfort can be made.
* This mill is designed ergonomically to make exercising an enjoyable experience.
* This is perhaps the most suitable device for everybody who can enjoy exercise as well as milling the rice for their day-to-day use.
* The output capacity of mill is 10 kg. Rice per hour approximately.
* Output capacity of the mill can be increased upto 18 kg/hr when it is driven by electric motor of 1HP.

Advantages over other known alternatives

- The output capacity of those power/diesel-operated hullers (mills) are several times more than the traditional pounding method.
- This is not practically suited for rural people because of high cost and lack of power supply.
- The diesel-operated hullers contribute to environment problem whereas the pedal operated mill is environment friendly.
- Additionally, power/diesel operated huller are installed at community centers/places, the individual rural household people will have to track the distance both ways wasting time.
- The Pedal Operated Rice Mill can ensure an output of at least 3 times more than the traditional pounding method.

Physical Achievements

1. Fabrication of ten nos. of the Pedal Operated Rice Mill has been completed and distributed for demonstration.
2. Union Minister of Science & Technology has been briefed about the Pedal Operated Rice Mill by the Principal Investigator in the inaugural function of 3-day training programme of State Patent Information Centres from July 28 to July 30, 1998 at Technology Bhavan, New Delhi.
3. The Mill has been demonstrated at the Golden Jubilee Exhibition of India's Independence (9-14, August 1998) at Imphal.
4. Testing of the Mill at Community Polytechnic Society, Imphal has been completed.
5. Shri Th. Surendranath Singh, Principal Investigator of the project has been honoured with National Invention Award 1999 – distributed by the Hon'ble Union Minister (S&T), Dr. M.M. Joshi on the occasion of 1st National Technology Day Celebration at New Delhi, May 11, 1999.
6. The invention "Pedal Operated Rice Mill" has been included in the "Limca Book of Records – 2001" in the category of World Record
7. Patent has been filed under Ref. No. 900/DEL/98.

Calculation of Kinetic Energy & Work Done:

Mass of the flywheel, m = 5 Kg. = 5 x 10^3gm.

Distance from the axis, r = 17.25 cm.

Angular speed, ω = 680 rpm = $\frac{680 \times 2\pi}{60}$ radians/sec.

= 71.21 radians/sec $\because \pi$=3.14159

We know that,

Moment of inertia, $I = \sum mr^2$

$= 5 \times 17.25 \times 17.25 \times 10^3$ gm.cm^2

= 1487812 gm.cm^2

The kinetic energy of the flywheel over the drive shaft of the Pedal Operated Rice Mill will be

K.E. = $\frac{1}{2} I\omega^2$ = 377.22 x 10^7 ergs

Since 1 erg = 10^{-7} Joules

$\therefore$ K.E. = 377.22 Joules.

= 376.16 Watts Since, 1 Joule = 2.77 x 10^{-7} KWh

= 0.5042 Hp. Since, 746 W = 1 Hp.

The unit of all forms of energy and work have the same unit.

$\therefore$ work done, W = 0.5042 Hp.

PEDAL OPERATED RICE MILL

(Prototype is developed under a sponsored Project of Dept. of Science & Technology – Science & Society Division, Govt. of India)

SHRI THINGUJAM SURENDRANATH SINGH receiving NATIONAL INVENTION AWARD
from Dr. MM Joshi, Hon'ble Union Minister for Science & Technology at Hotel Ashok, New Delhi
on the First Technology Day Celebration May 11, 1999
(Award sponsored by National Research Development Corporation, New Delhi)