

Indian Water Mills

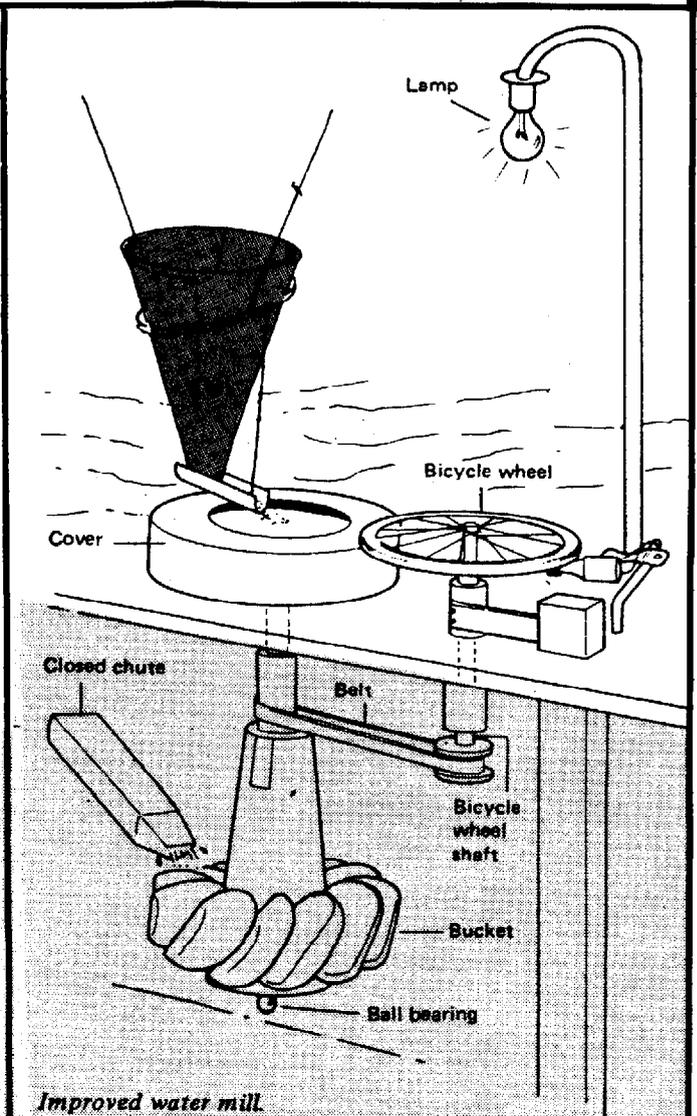
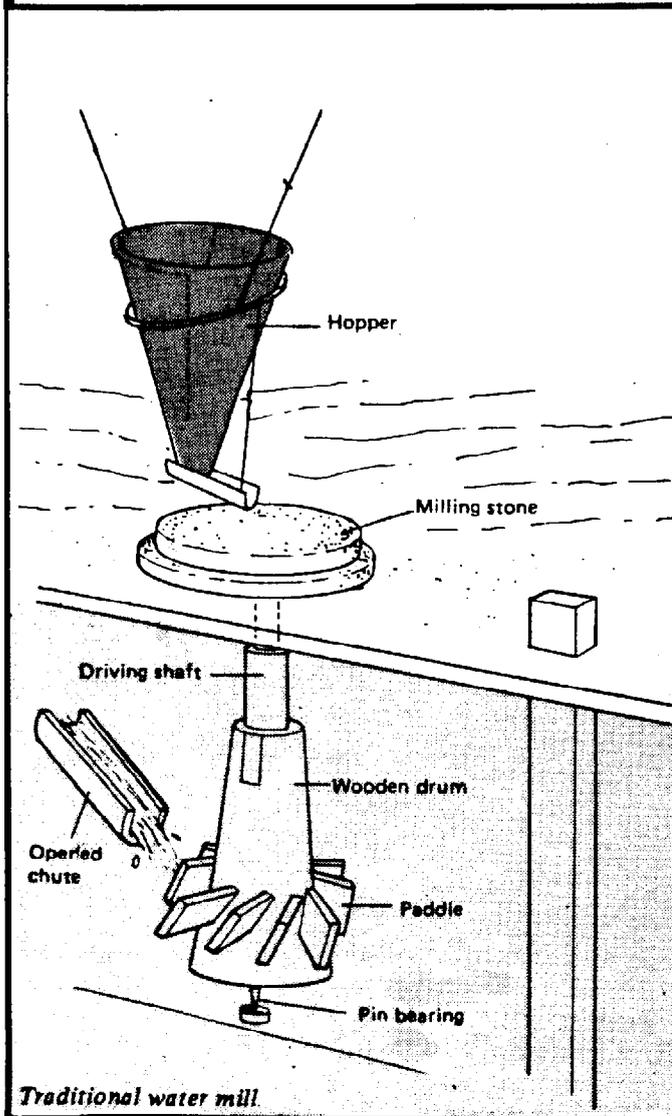
Simple, low technology, easy to construct water mills can be used for a variety of tasks if you have a reliable source of water. For many hundreds of years large numbers of simple water mills have been operating in Nepal. Recently an effort was made to update the design. Both the old design and the new design offer interesting possibilities for those interested in water power.

When the idea of increasing the efficiency of the old mills was developed it was hoped that this would make it possible, not only to increase the amount of grain that is ground, but

also, to use the water mills operating small machines such as saws, drills, machine lathes, paper pulping, water lifting pumps, etc.

It was decided to carry out the first stage of improvement work on one of the existing mills. For this a brief survey of the mill sites was necessary to find the most appropriate one, fulfilling the following criteria:

- a. it should be located as near as possible to the centre;
- b. it should be as near as possible to an accessible road;



- c. it should have a continuous flow of water with an abundant flow rate throughout the year;
- d. its owner should accept the idea of improving his mill and should be co-operative;
- e. the work should not interfere with the customers.

To find a suitable mill a brief survey lasting a couple of days was carried out. Eventually, two mills were found owned by the same miller, one of which fulfilled all the above criteria. It was not in use at the time of the survey as it needed some repairs. After a verbal agreement, necessary repairs to the mill were carried out. At the same time different measurements of the mill, water head, flow rate, turbine components etc. were taken in order to design an improved water mill. such an improved water mill should have the following advantages:

- a. better efficiency;
- b. more power output;
- c. more comfort;
- d. more saving of time;
- e. reduced expense.

To achieve these advantages it was necessary to record the characteristics and performance of the existing traditional water mill. It has a turbine with flat paddles entirely made of wood. A flow of pressurised water coming down through an open wooden chute strikes the paddles. This causes the whole turbine to rotate on a pin bearing fixed on the bottom of the turbine shaft.

Looking at this traditional system it seemed that improvements could be achieved by:

- a. replacing the flat paddles by curved buckets thus taking advantage of both impulse and reaction forces on the buckets;
- b. replacing the flat open chute by a closed one to utilise the full pressure;

- c. replacing the pin bearing by a ball bearing to increase the life-span of the bearing itself and to obviate the increasing resistance caused by the pin bearing wearing out.

Improvement works and results

A number of curved wooden buckets and a chute with a nozzle at its end were made exactly according to the appropriate calculations. The pin bearing was replaced by a ball bearing. Besides that a flour collecting system was designed to help the miller or customer avoid loss of time and labour spent in brushing up the flour scattered all around the stone and collecting it in the containers. A mill stone covering device was also made to prevent loss of flour from the mill. It also seemed very important to have electric light inside the mill both for the miller and the customer. So, a lighting system made of a bicycle wheel and dynamo was installed for the purpose.

Parallel to these improvements tests were carried out on the traditional mill system. Its r.p.m., efficiency and power output were measured. After these tests the new system with curved buckets, closed chute, steel ball bearing and other additional devices was installed and the same parameters were measured. The result is tabulated below:

S.NO.	Type of mill	r.p.m.	Power output (H.P.)	Eff-iciency	Pro-ductivity pathi
1.	Traditional	156	1.120	21%	4
2.	Improved	230	2.024	38.2%	6

The numbers in the table show the r.p.m. have been increased by about 480, the power output by 81%, the efficiency by 80% and the productivity (in the case of maize) by 50%.

Cost Benefit from the Improved Water Mill

So far the cost of the new system compared to the old is briefly contained in the following table:

S.N.	Description	Cost of trad'l mill*	Cost of improved mill*	Price incr.
1.	Turbine shaft (Madami)	200	200	-
2.	Paddh (Pati) (12 Nos)	120	600	480
3.	Bearing	20	50	30
4.	Driving shaft (Mane)	25	25	-
5.	Metal Key (Phali)	15	15	-
6.	Millstone (runner & bed stone)	400	400	-
7.	Spacing control lever (Juwa Kath, Ubhyaune Kath)	70	70	-
8.	Chute (Doonen)	250	400	150
9.	Hopper, agitator etc.	50	50	-
10.	Lighting device	-	370	370
11.	Flour collecting device & cover	-	200	200
12.	Installation cost	100	200	100
13.	Shed cost	1500	1500	-
	Sub total	2750	4080	1330
	Contingency 10%	275	408	133
	Grand total	3025	4488	1363

*In rupees.

The above table shows that the improved water mill costing around Rs. 4500 is costlier by some Rs. 1500 when compared with the traditional one. Let us see whether this price increase is justified.

Previously, the productivity of the mill was around four pathis of maize per hour. With the improved mill it increased to about six pathis. The mill works for about 4000 hours per year, grinding 8000 pathis more than before. This brings an additional earning of

Rs. 4000. Besides that the miller saves on kerosene worth Rs. 200 per year because of electric light. This already amounts to a saving of Rs. 4200 per annum. Furthermore, the improved mill prevents the flour from scattering around the mill. This would otherwise mean a loss of 80 pathis per year. If the whole thing is assessed from the standpoint of time saving, comfort and health, the increase in cost is indeed justified.

Conclusion

The work on the improvement of a water mill has now completed its first stage. It shows that the traditional water mill can be considerably improved with a little effort. Already the results obtained show that there is a possibility of diversifying the power derived from these mills for operating some simple machines which (even if it sounds a bit exaggerated) can eventually lead to the establishment of a small-sized cottage industry.

Taking all these possibilities into consideration it seems necessary to carry out further research on:

- effects of different blades (buckets), types of chute (penstock pipe), bearings and grinding stones both on the traditional and the improved mill;
- effects of different grooves on different sizes of millstone for grinding various kinds of grains;
- possibilities of reducing the cost of the whole system.

Only the outcome of this research will show how far the traditional water mills can be improved.

This article is based on an item in *Appropriate Technology*, Vol.7, No.3 page 26, by Chandra Bahadur Joshi. You can get more information on this item and the publication "Appropriate Technology" from I.T. Publications Ltd, 9 King Street, London, WC2E 8HN U.K.