

## ITALIAN WATERMILLS: PROBLEMS & PROSPECTS

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There is very little information about Italian mills in English (1). There is not much easily accessible even in Italian, so the first problem is to get some general idea of the distribution and typology of Italian mills, both extant and in the past. For present purposes I shall concentrate mainly on extant remains. Perhaps one

Perhaps one of the most striking and interesting aspects of Italian mills is the importance they had in the late 19th century for the entire political situation in Italy. In 1869, the new Italian State found it was very short of funds and the Finance Minister decided that the grinding of wheat should be taxed in order to make up the deficit. The novelty and 'beauty' of the plan was that the system of taxation was to be based on a meter worked from the revolutions of the millstone, and hence produce a perfectly equitable tax. In practice, the system worked extremely badly; The price of bread shot up, while the smaller millers (which meant most of them, in Italy) could not pay the tax and threatened to close their mills. There were inspectors standing around in mills trying to assess or re-assess the amount taxable, and there were riots in which many people were killed. The tax struggled on until 1880, when it was repealed, but it is a striking and unusual example of a direct political and social influence of water mills.

The particular relevance of the tax in this context is that it led to a Royal Commission. It published its findings in 1872, and from these we can deduce that the number of mills in Italy at that time was approximately 74 000. I have made a modest start in trying to work out their distribution, particularly in relation to the type of wheel.

In some Alpine areas such as the Dolomites, particularly in the Cadore area (Fig 1), it seems to me that there are very many examples of corn mills closely associated with sawmills, and frequently, a forge. The sawmill is of the type known as "Veneziana"; a reciprocating frame saw type in which the logs are fixed to a heavily-built trolley with a back, against which they are jammed with various types of wedges. I have not space to describe this system of sawmill in detail, but there are one or two points of interest in the context of our present discussion. Millwrights for this type of sawmill seem to have come from Pusteria, a valley to the north of the Cadore area, which was formerly in Austria. Is this basically an Austrian type of construction? However, the mills of this area seem to have been part of the chain of the supply of timber to Venice; so here is an inherent conflict to be resolved.

I have already mentioned that this type of sawmill seems to be generally associated with a corn mill, and frequently a forge, on the same site. These were all driven by small-diameter waterwheels (average 1.2m) with a steep wooden chute down from a wooden launder, each with its own separate chute and separate mechanism inside. The gearing is almost universally a one-step trundle type.

It is not unusual to find five waterwheels fed from the same launder. A typical arrangement of this kind can be seen in Fig 2, where to the right of the illustration are two mills belonging to two different families; the one with living quarters (note the kitchen, "cucina") and to the left of the sawmill ("segheria") belonging to the same family as the first mill. In certain mills built expressly for the use of a particular family or village, the several functions performed by water power have been combined into the one building, and a good example can be seen from the sketch plan in Fig 3. Here, a turbine (dated 1891) drove two pairs of stones, a pair of edge runners for crushing barley, and a sawmill.

The ground floor houses the turbine in a separate compartment with a shaft going through the wall. A gear from this drives the lineshaft, which carries large wooden pulleys, approximately 1.2 m diameter by 300 mm wide. These are connected by belts to the trundle gears for the two pairs of stones (which are on the floor above), and to the edge runners on this floor. Another belt nearer the turbine drives the crank and pitman of the reciprocating saw. On the first floor we find two pairs of stones with stone cranes, and in a separate room, the six-metre long trolley of the saw. There is no place here to describe this mechanism in detail.

Other mountain areas seem to have contained large numbers of horizontal wheels. The article by Philip Grant describes a number in Tuscany, while a study of Pistoria in the Middle Ages, of approximately 350 corn mills described in mediaeval documents, there is no discernable trace of any vertical wheels. However, in this area, even in the Middle Ages there must have been vertical wheels in the towns for industry. Indeed, if we look at the old town plans of some of the cities which were well supplied with water, such as Padua (Fig 4), there are clear signs of vertical waterwheels on the watercourses. Many can be identified from street names; for example, fulling mills, corn mills, etc.

In the plain, however, a different pattern emerges. To this day there are some (though perhaps not many) waterwheels still working in the Veneto plain, i. e. in the same region as the mountainous area described under sawmills. I found two close by, in this area with Poncelet-type wheels coupled to electric motors (the output was about 35 H.P. from the wheels and slightly more from the electric power). These large vertical wheels in the plain pose the further problem of why these should have survived to drive modern roller mills rather than others. In this case I would suggest that the particular river where these are found furnishes a peculiarly reliable water supply. It is astonishing to find a full river of limpid green water in the height of a very dry summer in August. It appears that the river is never subject to drought or flood as it only arises about 15 km from the first of these mills, emerging from the ground as a series of springs.

Here then we have various types of mill, various systems, and various problems to be investigated. Fortunately some useful serious studies are now emerging; e.g. a detailed study of the grist tax crisis, a recent manual and glossary of modern roller-milling including historical accounts of various parts of milling machinery, and a study of the industry of a valley in Piedmont, including tilt hammers, etc.

In conclusion, I consider that the prospects are good of being able to construct an overall picture of milling in Italy, based on fieldwork and documents of every kind (including printed works, family histories, archive material), and of course, local informants.

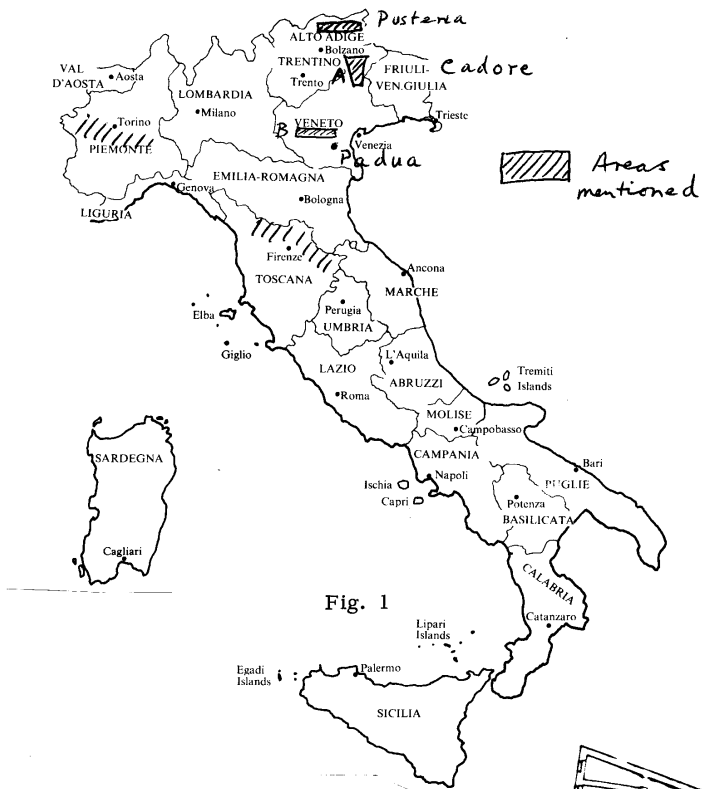


Fig. 1

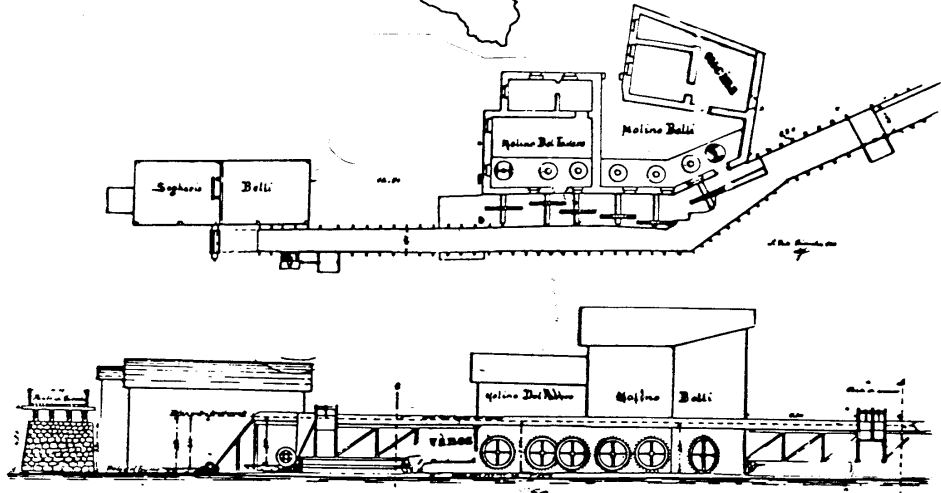


Fig. 2

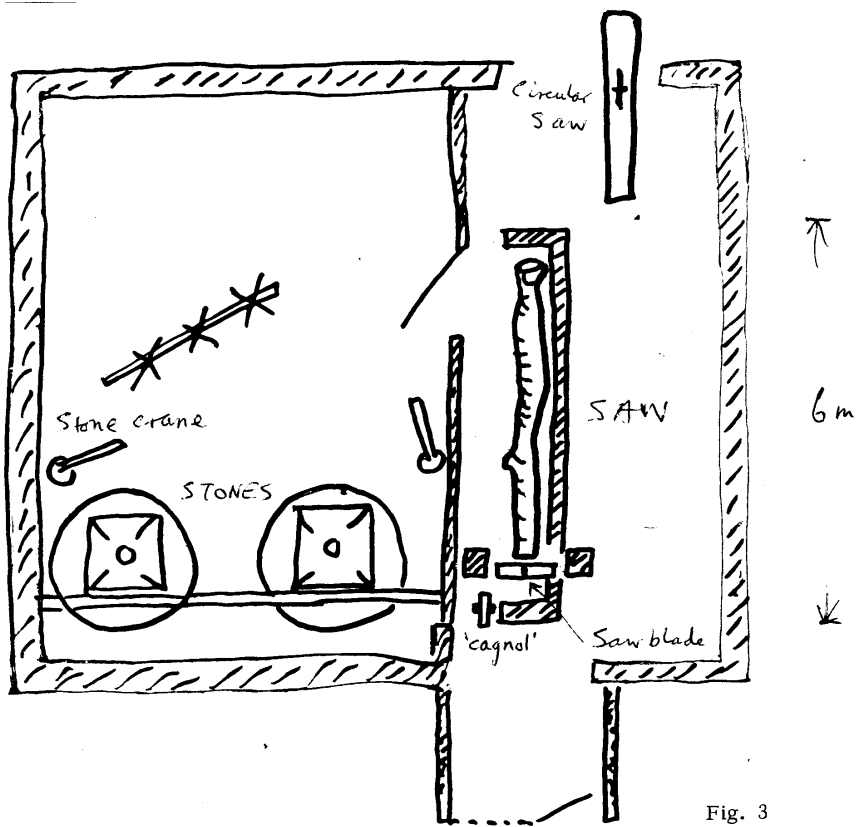
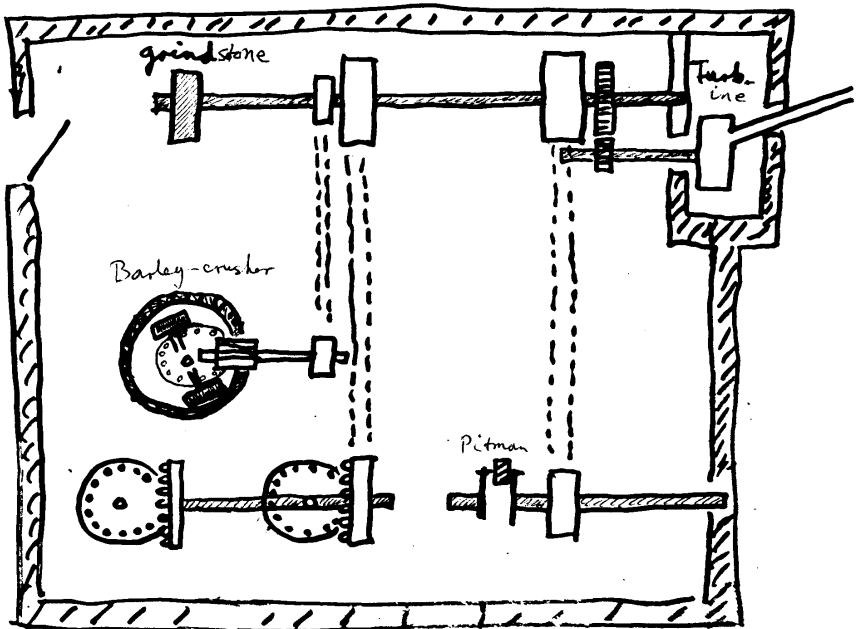


Fig. 3



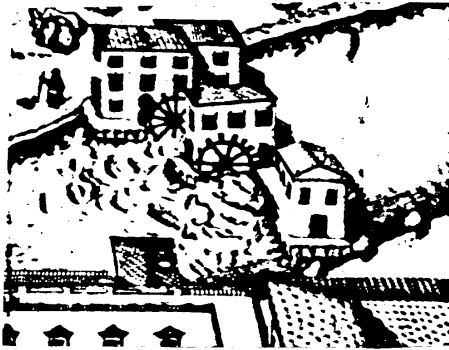


Fig. 4. Detail from a town plan of Padua, 1680.

#### Discussion

- Jarvis I was surprised to see so much wooden gear, such as a lantern pinion driving a shaft to the stones; a lantern pinion makes a terrible drive. It works quite well as a follower, but is abominable the other way.
- Freedman In this area there is so much wood, they use it for everything - if they can avoid using metal, they do. They couldn't really avoid using a metal shaft with plates on the sides of the pulleys. They couldn't get castings for the pulleys - they just didn't have the facilities for it, whereas the local carpenter was used to making anything out of wood.
- Bryan In the early part of your paper you showed some waterwheels which looked more like Alpine wheels; that is, overshot wheels with a trough sloping steeply down to them. Is that what they were? They seemed to be overshot, but it looked as if they had no sole boards.
- Freedman They are a normal overshot type of wheel, with closed buckets. I thought of it as a primitive turbine; it seemed odd to use such a small wheel to drive a sawmill. Why not use a big wheel, as we do, and gear it up?
- Bryan That is how Alpine wheels are made; a very small wheel, hit by a very high velocity water jet.
- Jarvis Of course, Italy isn't very far from that sort of country, is it.
- Jones I have seen illustrations of that type of sawmill from Canada to Poland. The thing they had in common was plentiful water and a concern for cheap construction, without gearing. On another point, I wonder if was any Austrian influence in the corn mills. Do any of them have any internal decoration; are any mechanical parts decorated, particularly round the stones?
- Plunkett You mean carved horse furniture, etc, this sort of thing.
- Freedman No, very little. I don't remember seeing any, and I would have noticed it if there were any. I know the sort of thing you mean; the kind of Austrian baroque floral decoration, scrolls and things. No, it is true that going north, it is quite a divide going over the mountains into the next valley. The architecture changes; it becomes much more Tyrolean, an Austrian type of architecture. In this area you get something similar, but it has an Italian stamp, not so decorated as the Austrian.