Querns

Historical Layers – Technical Regression

Attila Selmeczi Kovács

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The development of hand-mills used to grind cereals is surveyed by the study of implement history based on archeological and ethnographic data to follow the changes that have taken place in the structure and use of hand-mills in Central Europe from antiquity to our days. Considering the structural changes that have taken place during the past two thousand years it is possible to speak of several basic types. While the implement with the simple structure used in antiquity has been preserved without any significant alteration up to the present time, the medieval structure has been significantly simplified since the 15th century. The study investigates the relationship between this regression process to the major mills of industrial size of modern times and to the more productive hand-mills of transmission structure which became popular after the 16th century to play important role in the food supply during wars. The transmission type hand-mills are typical implements of modern times. The development of the historical layers of hand-mills and the technical regression of the medieval type of implements are closely linked to the methods of use, to the changes of the raw materials to be processed and finally to the historical development of the culture of nutrition.

Dr. Attila Selmeczi Kovács, deputy director-general, Ethnographical Museum, Kossuth Lajos tér 12 H-1055 Budapest.

Round grinding stones made their first appearance in the 7th century B.C. in the regions of the Aegean Sea and the Black sea. According to earlier archeological reconstructions they were first operated by straight movements: with the help of a wooden handle attached to the upper stone that stone was pushed and pulled on top of the lower stone. A hole was drilled through the upper stone's centre, and it was through that round hole that the grain was poured to be grinded (Feldhaus 1931: 17). Other views are that the two cavities in equal distance from the central hole served as fasteners of a short driving rod each fixed perpendicularly, with the help of which two persons operated the mill with discontinous motions made in alternate directions (White 1968: 91).

In the case of discontinuous revolving motion there already emerged the technical element to prevent the stones from slipping off from each other's top. Although the fact that the surface of the lower stone was made convex, and that of the upper one concave, also served such a purpose. It is even more important that the lower stone had a shallow cavity in the centre which suggests the existence of a centralizing axis on the upper stone (Stehlin 1919: 121). The axis which supported the upper revolving stone used to be made of wood in the earliest period (Forbes 1956: 109; Lies 1963: 289, 295; Henning 1966). The development of the quern was made possible by the employment of the *axis*, or rather by the improvement of the centralisation of the round mill stones, which also provided the basis for the further progress of the querns. The »invention« of the rotary mill was in fact nothing but the employment of the rotation principle – already known and employed after the third millenium B.C. in Mesopotamia for the wheels of carts and for potter's wheels – for the grain milling tool.

The Greek type of the first rotary mill became popular in two different forms: one was

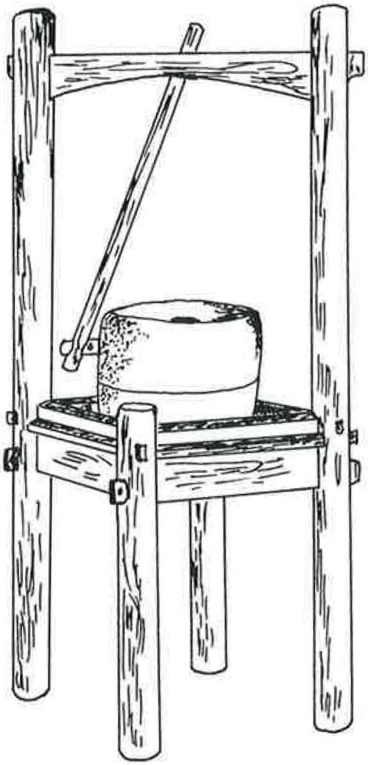

Fig. 1. Reconstructed Celtic hand-mill. Rütimeyer 1924.

the fixed *donkey mill* operated by animals or slaves. It was a mill of large size. The other one was the actual *rotary hand-mill*. The first type came into use by the Romans only after the second century B.C., and the best known pieces are the mills excavated next to the bakeries of Pompeii (Blümner 1912: 34–44; Curwen 1937: 151; Clark 1952: 112–113).

The rotary hand-mill which was more important from the aspects of peasant households became significantly widespread in North Europe in the third century B.C. with the Celtic people in the La Téne cultural zone. Lately the concept prevails that the Celtic people have adopted its use from the Greeks they contacted, and they helped spreading it to a large part of Europe (Forbes 1956: 108; Gleisberg 1972: 3). The Romans have also learnt the use of the quern from the Celts, and employed it as part of the equipment provided for the legions, such a tool supplied ten persons (Brentjes – Richter-Sonnemann 1978: 97).

The reconstruction of the Celtic type quern was based on the mill-stones found in the lodging cavities of the significant Celtic settlement (Rauraker) excavated in the vicinity of Basel (fig. 1). The Celtic or Gallic hand-mill form presented has been reconstructed by Karl Stehlin for the Basel Museum of History's exhibition using the models of Polish, Bosnian and Galician ethnographic items of the turn of the century (Rütimeyer 1924: 230). However the Gallic hand-mill stones of 58 B.C.excavated in the vicinity of Basel were found, by Major, without any support whatsoever (1917: 164–167). No archeological item has of course been found yet to prove to what extent the wooden construction which is supposed to resemble an item of the mid first century B.C. is true to reality.[1]

The quern reached Central Europe through the Celts and later the Romans. In the La Téne period the Celts manufactured very specialised querns. In the Carpathian basin the Celtic mill-stones were made of vulcanic rocks. Jan Filip (1961: 118) presents the products of these workshops, that is the querns made of two stone discs weighing 40 kg each – and similar to the former reconstruction in a form supported by a stand. On the other hand the Roman hand-mills became popular in Central Europe only during the late La Téne period (around the first century) replacing the Celtic type hand-mills (Beranová 1963: 197–198).

There is an evident difference between the provincial Celtic and Roman type mill-stones. The mill-stones found in Celtic settlements are of pronounced conic shape. The steep grinding surface speeded up the milling process producing flour of inferior quality. The technically backward Celtic hand-mill was widely used in Dacia in the La Téne period and continued to remain popular there even in Roman times. The Roman hand-mill started to gain ground after the first century. The Roman hand-mill is much more flat and is of a larger diameter than the Celtic one. From the technical aspect the difference means that the larger grinding surface made the milling process easier and slower, thus as a result of extended grinding flour of finer quality was produced. The upper stone of the reconstructed Roman hand-mill,

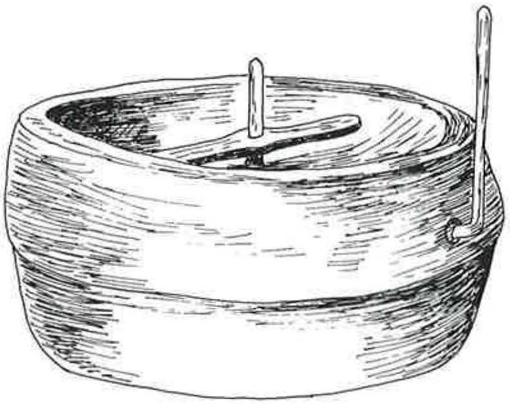

Fig. 2. Provincial quern of the Roman times. Branga 1973.

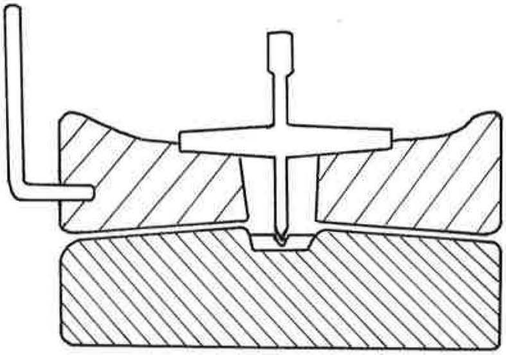

Fig. 3. Structure of the Roman type quern. Bucur 1979.

which was centralised with the help of an iron axis had a short iron driving handle fixed to its side to make it turn (Branga 1973: 44–45, 52–55; Beranová 1980: 82–83) (fig. 2).

The Roman hand-mills of former Pannonia were of similar form. The mill-stones of Roman times of the Carpathian basin were basically of a uniform type. On the side of the slightly conic shaped upper stone there was a horizontal cavity to fix the driving handle (Beranová 1963: 196–200). The two regular cavities often present next to the central opening of the upper surface of the rotating stone – drilled for receiving the grain – were related to the centralisation of the stones of the hand-mill. The reconstruction suggests that the cavity in the centre of the lower stone had a vertical iron axis rotating in it, and that axis was attached to the rotating stone by an iron bolt in the middle. The axis which was in effect cross shaped was also suited to regulate the distance between the two stones, and consequently to influence flour quality (Bucur 1979: 186) (fig. 3).

Lynn White has called attention to an important motive which is generally prevalent in the development of hand-mills. According to him for generations no notice has been taken of the fact that the *cutting effect* and only to a much lesser extent the compressing force derived from the weight of the upper stone caused the grains to be grinded; neither was it noticed that the flour became equally compacted when milled by a troughshaped lower stone or by a flat one. Consequently old-time mill-stones were heavier and of varied shapes. With the passing of centuries the surface of the hand-mills stones became gradually smooth, and the stones became thinner as well. The significant reduction in the weight of the revolving stone made it possible to fix the driving handle to the upper surface of the stone. However it is rather uncertain when such a development actually took place, as for example the excavations in the Austrian Saalburg along the Roman limes has brought over a hundred mill-stones from the first to third centuries to the surface, and all of them had cavities on their sides for horizontally attached driving handles (White 1968: 90–91).

The axis of the Roman type quern revolved

Fig. 4. Potmill from 1517. Exhibited by the Österreichisches Volkskundliches Museum, Wien.

Fig. 5. Salt-grinding hand-mill. Jászjákóhalma, Hungary.

around the shallow cavity cut in the centre of the lower stone and had a short driving handle attached to the upper stone, thus it was a construction which could be operated without a stand. We can assume that this type of hand-mill had no defined stand, similar to the medieval potmill (fig. 4) which had the same form and structure (comp. Maurizio 1916: Pictures 17. and 25; Stronczynski 1880: 40; Bomann 1927: 150) and to the recent hand-mills for grinding salt (fig. 5). The hand-mills of that latter type were placed on the ground or threshold, or were used when standing on provisory supports, benches or tables (comp. Keyland 1919: 139–142; Selmeczi Kovács 1981: 33–41). Based on the similarity of forms and the area of use we can presume that these implements were historically related.

Although much less is known about the structure of the Celtic type hand-mills, it can be presumed that it operated similar to the Roman ones, namely that the axis structure, used to centralise the stones, in the same way was fixed to the lower stone and required no stand to be operated. The driving handle had to be attached similarly to that of the Roman type.[2]

The querns, identical in their structure and operating without stands, also can be regarded as the earliest classical or ancient historic type.

It was in the middle of the first century, that lower mill-stones were made, which were driven through in the middle (Rütimeyer 1924: 229; Beranová 1963: 217). The longer axis to go through started to be widely used only in the fifth century (Lies 1963: 319). Although no reconstruction exists of that period, we can assume that the change was related to the development of the centralising system of hand-mills in medieval times. The most important feature of that system was that the axis which went through the lower stone was supported at its lower end by a horizontal *frame* while the upper end was fixed to a cross-bar attached to the runner (fig. 6). This new structure had the great advantage that it made it easier to regulate the distance between the stones. Because earlier the upper stone had to be removed every time to place a properly sized pad (a piece of iron or wood) under the axel. Here the cross-bar supporting the axis could be lifted or lowered with the help of a *wedge* to change the distance between the stones. However this solution had the disadvantage that the mill-stones could no longer be operated without stable mounting.

Several attempts had been made – especially

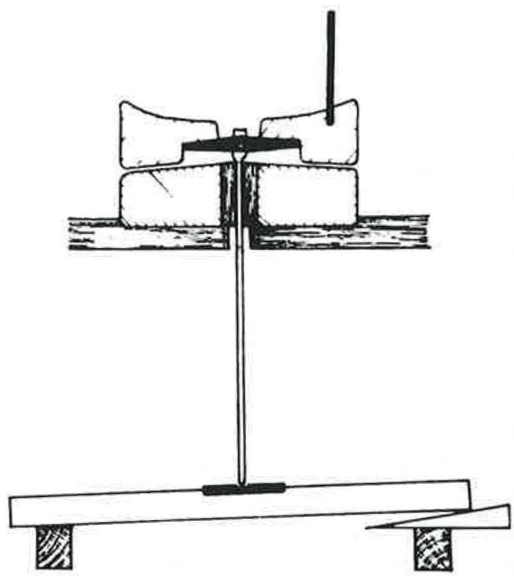

Fig. 6. Reconstruction of the principle of medieval hand-mill. Bucur 1979.

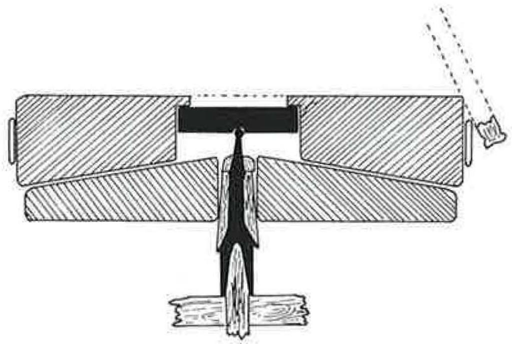

Fig. 7. Structure of the Russian hand-mill of the 12th century. Ribakov 1949.

by Slavonic archeologists – to reconstruct the medieval hand-mill structure (e.g. Niederle 1921: 113–123; Černohorský 1957; Beranová 1963; Hensel 1965: 56–58). There are significant finds only from the twelfth century with the help of which the medieval type of mounted hand-mill can be reliably reconstructed. The hand-mill described in detail by Ribakov B.A. was found in a Russian settlement of the late 12th–early 13th century, and was of a more advanced structure. The iron axis of the hand-mill was on its lower end supported by a mount of wood, and on its upper end fitted into a shallow cavity in the centre of the cross-bar of the runner. The upper stone could easily run on the pointed end of the axis as the friction surface was insignificant in size. There was some material at the axis's end in the cavity of the lower stone (wooden wedge and cloth) to prevent the grit from scattering (Ribakov 1948: 421) (fig. 7). This also helped to regulate the distance between the stones, as with the help of the wedges the lower stone could be placed higher or lower. Thus it was easy to change the grit's quality.

It is worth noticing the way the driving handles were attached. The runner was girded by a bast ring close to which the remnants of a wooden handle were found. According to the reconstruction the rather heavy (32 kg) upper stone was rotated by a long rod the lower part of which was attached to the ring and the upper end to the ceiling. The ring also served as protection against the effects of the centrifugal force. The flour which kept on puring all around from between the stones was collected in wooden cases next to the mounting. The diameter of the hand-mill stones found in Vstsizh was 35 to 40 cm. The large number of the hand-mills, their complex structure and contemporary sources suggests that the hand-mills was manufactured by specialists (Ribakov 1945: 16–19).

The hand-mills the Hungarians used in the 11th to 13th centuries were in their form identical to the ones used by the Russians (fig. 8) (Méri 1970: 73–76, and Table II. Picture B). The structure and productivity of that instrument corresponded to those of the most advanced hand-mills of those times. The distance between the stones used to be regulated by moving the axis, and the upper stone running on the pointed axis-end was operated with the help of a long handle. The upper stone was girded by a ring of strap, rope on which a loop or juncture was formed for the handle. The

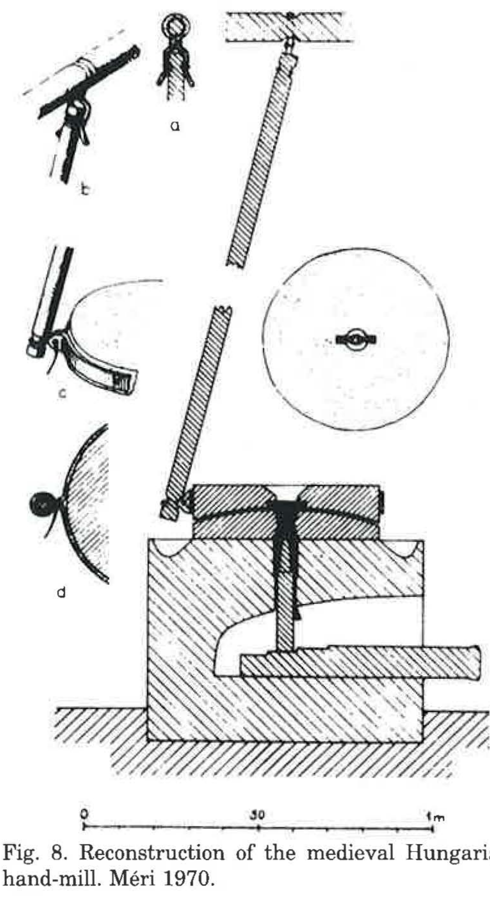

Fig. 8. Reconstruction of the medieval Hungarian hand-mill. Méri 1970.

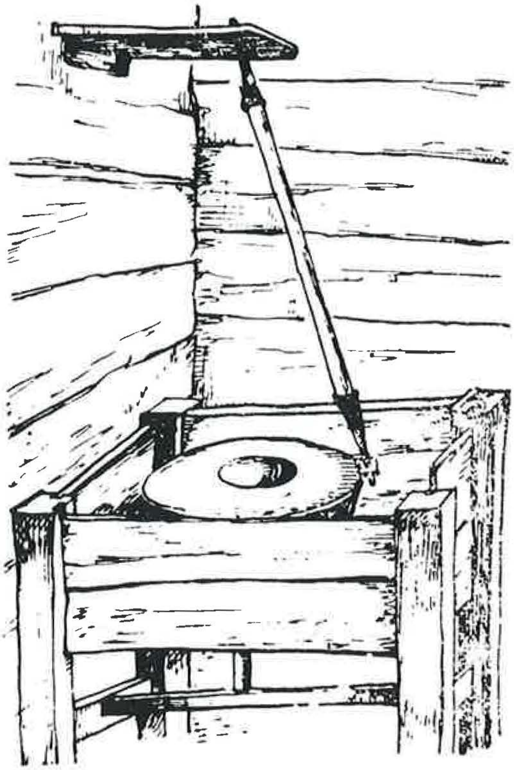

Fig. 9. Rim-driven hand-mill from Lithuania, from 1915. Maurizio 1927.

upper end of the crank was in a manoeuvrable way also attached to the bar. This special way of attaching the crank explains the smooth surface of medieval runners – which used to perplex people. From the 6th century onwards were generalized upper stones with flat surface without any hole for a crank-arm on the side (Lies 1963: 316). Henning reconstructed their rotation by pressing a crank-arm into a rope-ring girding the upper stone. This medieval implement could produce 2 kg of wheat in 33 minutes of which 640 g was pure flour and 1360 g grits (1966: 81–83).

The *attachment of the crank to the rim* as the means to run the upper stone of the hand-mill could be found not only in archeological material but also on tools which were quite recently of everyday use in several parts of Europe, as well as those in museum exhibits (Karutz 1926: 26–27; Zelenin 1927: 89; Moora 1980: 125, 128). The characteristic attachment of the crank to the rim was reported by Maurizio based on a drawing dated 1915 by Szuchiewicz from Lithuania (the village Nacza) (fig. 9). According to that the iron ring , on the runner had a loop formed on it to hold the iron fitted crank-end (Maurizio 1927: 295).[3]

Studying *recent* Western and Central European material from the aspect of how the cranks are fitted it can be seen that without exception in all cases the cranks were placed in the shallow cavity on the upper surface of the runner close to the rim, without fixation. When the runner revolved, the centrifugal force prevented the crank from removal. This simple way of attaching the crank is known from rather early arcehological finds. When the Viking town of Haithabu of the 8th and 9th centures was excavated a runner was found with an inch wide hollow on its upper surface close to the rim. The reconstruction takes it to be part of a mounted hand-mill similar to the present form, with the crank fitted to the stone attached on its other end to the frame similar

Fig. 10. Hand-mill as depicted in the Hedvig Codex in 1353. Stronczynski 1880.

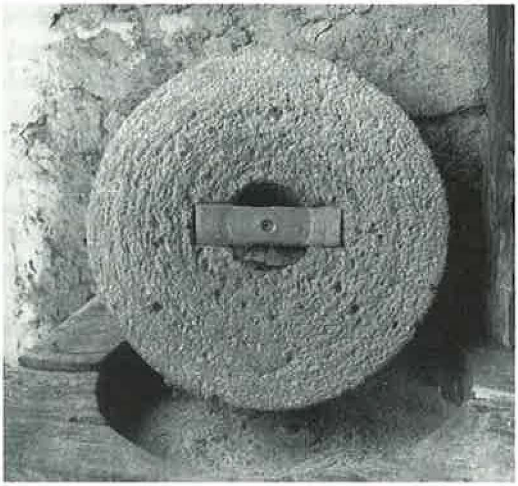

Fig. 11. Focusing the runner of the hand-mill with wooden parts. Mogyoróska, North Hungary, 1976.

to the Celtic type (Jankuhn 1938: 129; Gleisberg 1972: 4).[4]

Hand-mill depictions on miniatures of the 14th century all present the equipment with cranks fitted to the upper surface of the runner. The medieval hand-mill structure is best presented on the Polish picture in the Hedvig Codex of 1353 (Stronczynski 1880: 40; Niederle 1921: 118) (fig. 10). The crank fitted to the upper stone is fixed to the ceiling by its upper end. German and English miniatures of about the same age also depict hand-mills with cranks attached to the ceiling (Bennett – Elton 1898: 163–164). From the aspect of crank fastening it is interesting to learn that archeological mill-stone find from the 13th and 14th centuries have nothing on their surface to suggest any crank fixing, thus no hand-mills have as yet been found on 14th century locations that would correspond in structure with pictures of that period (Beranová 1975: 60).

Doubtlessly it can be presumed that the fixing of the crank rod into the surface of the runner was a more recent development, and started to be used in Central Europe only from the 15th century onwards. If compared to earlier solutions this type of fixing has simplified the structure significantly. The changes were related not only to the stability of the crank's attachment at its lower end, but also to the efficiency of the hand-mill's operation. Considering the fact that the torque (M) responsible for the speed of the runner depends on the one hand on the driving force (F) and on the other hand on (r), that is the distance between the stone's centre and the spot to where the force is applied, then

$$M = F \times r$$

thus the distance between the stone centre and the point to which the crank is attached at its lower end is of importance. There is a minimum of 5 cm of difference between the two types of fixing in the case of an average sized stone of 40 cm diameter. Thus with stones of identical diameters and applying identical force the stone which has the crank attached to the rim would revolve faster. In other words less force is needed for the same performance.

The calculation of performances related to the fixing of the cranks also proves that historically earlier querns were of higher technical standard, of more advanced structure. The simplification in fixing the crank could not be regarded as progress also from the aspects of productivity, as it meant lower productivity. Thus I regard the issue of fixing the crank important for this reason, and not only for reasons of form and typology – an issue neglected by researchers – as against the form and upper fixing of the cranks (comp. Horwitz 1934: 107; Nasz 1950: 56–59).

Another important factor in the development of mounted hand-mills is the *axis*, and related to that the issue of regulating the stones. As recent ethnographical materials include several mounted hand-mills without an axis, most of this simple equipment offer obvious analogies to help reconstruct medieval querns excavated only in the form of millstones. In his historic typology Maurizio regarded simplicity of form and structure as archaic criteria when he presumed that the earliest hand-mills were free of iron and axis (1927: 293). Such a hand-mill would have a wooden lintel in the runner, turning on the wooden pin fixed into the lower stone below (fig. 11). Such a solution can be taken as an axis-free form as the focusing of the stones are done by the short wooden pin in the opening of the lower stone;

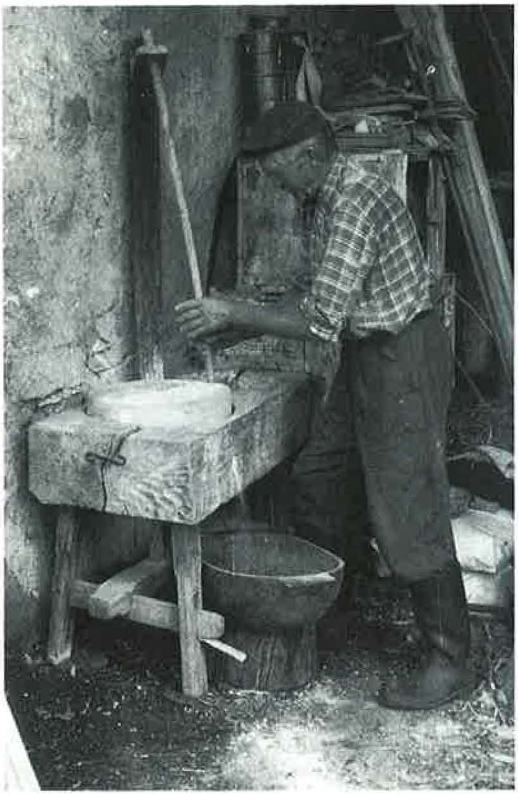

Fig. 12. Grinding with hand-mill equipped with wooden axle. Mogyoróska, North Hungary, 1976.

thus this pin does not help to regulate the distance between the stones.

Axis-free hand-mills may however be regulated, although at a primitive level. Several wooden wedges were put between the stones, or flat pieces of iron of different thickness were used for the purpose. Disregarding Celtic or Viking hypothetical reconstructions – the original structures of which are still not fully known – only from more recent centuries do we know of axis-free mounted hand-mills. The earliest known depiction of an axis-free mounted hand-mill is from 17th century Poland (Baranowski 1977: 13), and the earliest description of 18th century Germany (Gleisberg 1972: 4). Recent dates go back to the 18th century only. Thus this structure which looks archaic cannot be regarded as ancient. It has not been as widely used as the version with the axis, which had all its parts – with the exception of the stones – made of wood. The structure and operation of this form are identical to those of medieval handmills. The wedge placed under the slat linking the feet of the stand helped to move the axis mortized into the spread bar, while the upper end of the axis reached into the cavity in the centre of the runner's wooden lintel, thus the distance between the stones could be regulated (fig. 12).

Comparing the more recent hand-mills with the hypothetical reconstruction of medieval (12th and 13th centuries) hand-mills, undoubtedly we can speak of *technical regression*. This process of regression has a validity obviously only when regarded in a wider territorial and historic aspect. Arguments for technical regression include the wide variety of mounted quern forms, the European variants which are lacking the ethnic or regional character so typical of traditional items.

The great number of variants in the forms of mounted hand-mills as a matter of fact comes from two basic types from the aspect of how the cranks were fixed at their upper end: with the first type the crank was fixed to the ceiling, with the second one the much shorter crank-rod was fixed by the frame or supporting rod to the mount. The basic difference in form was also linked to the way the tool was used, which also suggests a time difference. The archeological reconstructions of 12th and 13th century hand-mills and depictions of the 14th and 15th centuries or 19th century rim-driven hand-mills all had their cranks attached to the ceiling, regardless on where they were made and used geographically. On the other hand for example the axis-free mounted ones, the ones of more recent construction all had their cranks attached to the support (comp. Baranowski 1977: 13). Based on the large number of examples we feel justified to conclude, that the fixing to the ceiling is typical to *graingrinding* hand-mills, as this is a standard supplement to the rim-driven structure, as the much longer crank-rod significantly increases the efficiency of running the upper mill-stone.

At the same time the fact that the crank-rod was fixed to the ceiling also suggests that the tool was fixed to a permanent place and was used regularly and for a long time. Such a tradition is reflected by the term *mill-stone* *corner* used to describe the corner facing the fire-place in Russian homes for example (Ribakov 1945: 19; Kupritz 1951: 21; Zelenin 1927: 90). However the shorter crank attached to the stand suggests the mobility of the tool, which is thus easy to transport and operate. This construction change must have meant that the quern had ben removed from its traditional place. The change in the construction that has made the mounted quern mobile as well as the consequent great variety of forms were striking evidences of the technical regression typical of the instrument.

When considering the structural transformation of the medieval quern and taking into consideration also the time factor of this regression we notice a strange contradiction. Archeological reconstructions suggest that the structure reached its peak perfection in the 12th-13th centuries. On the other hand the structural simplification could not have taken place before the 15th century. It is also known that the significantly more productive water-mills started to appear in Central Europe already in the 10th century, and became quite widespread by the end of the 11th century (Bloch 1963: 801). It is equally strange that the structural regression of mounted hand-mills coincided with the standard warring period when armed fightings on the continental scale did more harm to immobile water-mills and horse driven mills.

The early history of water-mills did not outplace other types of grinding instruments. At first basically water mills supplied the Roman legions with the flour they needed, and these retained their role to supply the military up to the Modern Age. In the 11th to 13th centuries feudal holdings in Central Europe did not have the mill monopolies they had in Western Europe (especially in France) where not only serfs, but free vassals also were obliged to have their grain milled in the water-mill of their lord. In contrast both in Hungary and in Russia feudal estates ordered that compulsory grain deliveries should be made in the form of bread and flour, thus the peasants were compelled to use their own hand-mills to fulfill those obligations (Makkai 1974: 45; Kupritz 1951: 22).

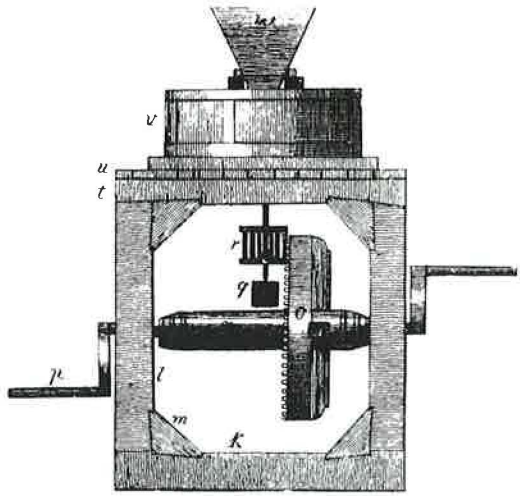

Fig. 13. Hand-mill with transmission structure, 18th century. Krünitz 1812.

There were several factors behind the local survival of grain-milling hand-mills, which even at the beginning of this century were of the more productive rim-driven structure. Only these sporadically surviving recent tools represent the survival of medieval hand-mills with mounted structure as against the continuity of forms that has been emphasised quite often (e.g. Nasz 1950; Gleisberg 1972). It is obvious that in earlier centuries, especially in the 12th and 13th centuries the role of water-mills was not big enough to immediately replace the hand-mills which at that time were already of high technical standard. Especially not when several hand-mills were operated simultaniously at a collective location (Hensel 1965: 58). When considering the relationship between the water-mill and the hand-mill we should primarily concentrate on the traditional quern suited to grain milling and of more advanced structure, as only continuous implements without technical regression could rival large mills.

Hand-mills were, from the very start, important accessories to warfare. They had a role not only in the supplying of Celtic and Roman legions, – a fact that helped them to spread all over the areas, but they had also to be included in the equipment of medieval armies, forts and ships. Descriptions of the hand-mills used by the armies prove that they were of different construction, as they were usually operated by two persons and had a more complex energy transmission system, and a greater productivity than the traditional querns. The operating principle of military hand-mills was also different from the structures earlier discussed, because with these the driving force running the stones operated not from above but from the bottom through a spindle gear transmission. The most simple structure was the following: a cylinder equipped with gear was attached to a frame to rotate with the help of a spindle on the axle of the horizontal mill-stone (Krünitz 1812: 21, Appendix 5784) (fig. 13). This structure could be operated by two persons by turning the tool vertically, which was easier than doing it horizontally. The hand-mill operated by two persons was of higher productivity due to the greater speed of revolution caused by the transmission, and developed in several versions.

This construction undoubtedly resembled the operation of large mills, although the origin and historical relation has as yet not been fully disclosed. However it is certain that it was used in several parts of Europe in the fifteenth century as "transportable mill serving military purposes" (Feldhaus 1914: 721). Contemporary sources unanimously emphasise the important role that structure played during wars, and refer to several hand-mill versions (Baranowski 1977: 12; Veranzio 1616: XXII, 22). The similarities of the tool to recent hand-mills in form and structure suggest that that military equipment has helped the construction to enter peasant households.

The transmission structure represents the latest historical layer of hand-mills. Its emergence and dynamic spread coincided in time with the structural regression of medieval mounted querns (15th-16th centuries). This coincidence is another argument for suggesting that the military significance of the new construction and its propagation were reasons for the technical regression of the traditional hand-mill structure. To support this argument it is worth recalling that the rim driven mounted hand-mills survived only in areas where the structures with transmission of Modern Era did not enter peasant households (e.g. Vuorela 1976: 62).

It follows from the changing role of medieval and modern hand-mill structures that the following question has to be answered: when a more productive tool also existed what made the regressive medieval type more popular? To answer this question we should start out by considering relationship between raw materials and technologies. So far when studying the hand-mill structures we always had in mind the main use of the tool: grinding grain. However ethnographic data prove that the hand-mills were used for a variety of purposes, such as grinding salt or crushing corn.

Ever since prehistoric times wheat has been the most important cereal in human diet. Archeobotanical studies disclosed that up to the Early Iron Age one- and two-seeded wheat: Triticum monococcum l., Triticum dicoccum Schrk. had been the most important types of wheat, and the normal type of wheat reached the Carpathian basin only in Roman times (Hartyányi-Nováki 1975). The first two wheat types are typically glumaceous types retaining the glume even during threshing, and it is only after crushing the grains that the glume can be separated by winnowing. Thus these types of wheat can be used only for pulp or flat cake which can be prepared of *grits*. And pounders or carborundum are perfectly suited to produce grits. It was only the production of common burst-wort wheat of which *flour* could be made that has made it possible, moreover required the use of quern which could grind better. This should explain the fact that the Celts and the Romans started to use querns at about the same time (Stokar 1951: 84).

Thus it was the spread of common wheat which launched the technical development of mills leading to the evolvement and stabilisation of bread based diets. However plant species of which pulps could be cooked – such a Triticum monococcum L., Triticum dicoccum Schrk. millet, but especially maize – which came from America to become from the 16th century onward staple food for the peasants – had for a long time retained their importance. Historically speaking much more pulpy food was consumed than dishes made of flour. Pulpy dishes made of grits formed a significant part in the diet of Greek and Roman peoples (Blümner 1912: 55–57; Bommer – Bommer-Lotzin 1961). The traditional role grits had paid in daily diets must have contributed to the survival of primitive tools used to prepare grits, such as carborundum, up to the Middle Ages (Črnohorský 1957: 512–516; Gunda 1961) and to the use of simple hand-mills from the 15th and 16th centuries onwards, as these simple structures have always been suited to grind corn- a much easier task than milling wheat.

The significance of grits based pulpy dishes in the diets leads to the obvious suggestion that the productive large mills specialised in flour production have met the demands of the population, while the demands in grits continued to be met by the hand-mills. Only fresh grits could make good food, especially in the case of corn, as corn-grits grow bitter when left standing for a longer period. Consequently the practice of frequent processing of small quantities made it necessary for the households to have their own hand-mills. And as the task was to prepare corse grits by *crushing*, that is by a less forceful operation, a simple instrument was suited to the changed task. Mass requirement favoured the simple structure that chould be made by the households themselves. Thus the raw material dictated technology and the structural construction serving it were in balance once again.

Finally we have to come to the conclusion that indirectly the large mills significantly contributed to the functional and structural simplification of hand-mills, compelling them to specialise, to degrade into a grits-making tool. The functioning dictated by the raw material naturally affected the structure. Among the factors leading to the structural regression of querns included the raw materials and dietary habits just as much as technical and historical effects, the coincidence of which resulted in a structure which was best suited to meet economically and socially defined demands, albeit by technical regression. This can be taken as warning to be careful when assessing the issues of archaism.

Notes

1. Though the position of the pair of mill-stones found by Nowothning W. on an excavated Vandal settlement of the first century B.C. made Stokar (1951: 88) conclude they did have a stand, but that conclusion was questioned by Gleisberg (1972: 3). Stokar himself has refered to the fact that the first proof of any stand structure to support the mill-stones is of the first century only. According to Lies (1963: 314) it is even more recent: of the second or third century.
2. This is also suggested by the data published by Branga 1973: 44–45 and Kuttelvašer 1969: 46.
3. Almost identical hand-mills are known from the same period from Germany, the museum of Nürnberg (Jacobi 1914: 87), Finland (Sirelius 1921: 263), Bielorussia (Moltshanova 1968: 47), Krk island of Yugoslavia (Miličic 1955: 190) and from 19th century Poland, from the region of Lomzy (Moszynski 1967: 271).
4. However this single find has as yet not been adequately evaluated.

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